THE

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ELECTRICAL REVIEW.

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SOME COAL STRIKE EFFECTS.

MANAGERS of electricity works in many instances are to be commended for the foresight which they displayed in securing large stores of coal in readiness for the strike. Frequently during the months preceding the throwing down of tools we published information showing that the strike was almost inevitable; but notwithstanding the strong determination shown on both sides, most of us hoped that something would happen to prevent matters reaching such a pass that there would be a strike still in progress after four weeks, which would so calamitously disorganise the industries of the nation. Whatever the effects of the struggle may be in other directions, we may single out two reflections on the situation for comment at the moment. One of these is that we believe that the country will require some strong legislative action to be taken which will in future prevent the wholesale holding up of industry by one class of workers. What is the use of all our social reform legislation, our efforts to improve trade and industry and to prevent unemployment, our setting up of Labour Exchanges, our establishment of relief works, if by other legislation we are to permit one class of the workers in whose interests we adopt progressive legislation, to plunge the nation into such a state of chaos that poverty and distress are present on an appalling scale? Thousands of families will be brought permanently lower as the result of this war on capital. For them, at any rate, all the benefits accruing from the social legislation of the past generation are thrown away. Surely the past month has impressed all who have their country's interests at heart with the folly of legislating for the bringing in of a "new heaven and a new earth," and simultaneously arming a section of the people who are to be the residents of that blissful abode with weapons which will at the first opportunity be turned upon their fellows.

The other reflection that must have occurred to most of our readers as the price of coal has risen, and as the advantageous position of electricity supply works and users has been made so plain, has been the necessity for taking advantage of this electrical opportunity to the full. Many managers of electricity works are already turning the occasion to account, and others should do the same, by an active propaganda among the users of power, and particularly among those who have had to shut down their steam-driven works through the want of coal. Many stations in industrial areas have been experiencing a great increase in the demand for power supplies, in order not only to secure the economy and special advantages of electricity, but the freedom from dependence upon coal or gas.

Publicity and sales departments can do great things to keep this movement going. Now is the time to circulate freely practical information as to all the advantages of the electric motor, and in towns where they are already drivin the machinery in local factories electrically, to publish the

results of the working, in the form of testimonials from those who have had the good fortune to adopt the system, for there is no better method of business-getting than the evidence of those who have been taught by experience, and whose testimony cannot be attributed to any self-interested motives.

The practical difficulties in the way of changing over from the old methods of steam and gas-driven machinery to the electric motor have to be met, and this is done where necessary by the supply of the electric plant on a hire-purchase system, so as to relieve, as far as practicable, the question of capital expenditure, by utilising the future savings in working for paying the cost of the alteration.

The prices charged for electricity are so moderate that apart from all the other advantages obtained from its use, it is the most economical source of power, but even if it cost the same as steam, gas or oil, per horse-power generated, the convenience of being able to limit the consumption to the actual power usefully employed, constitutes a considerable percentage of saving.

When the other items are considered, such as interest on capital invested in plant, wear and tear, depreciation and obsolescence, rental of space, cleanliness, saving in wages of engine-drivers, &c., the savings by adopting electric driving from a supply company's mains are obvious.

At this moment, when the business-getting experts should be making a raid upon the power-users who are suffering from the want of coal, it is well to speak freely of the obvious benefits derived from the electric motor.

Popularising Electricity.

A visit to the Electricity Hall at the International Smoke Abatement Exhibition can be cordially recommended to our readers; ladies especially are sure to be interested in what they see, for the electric cooking section is by far the most comprehensive and varied that has yet been organised, and every facility is given for visitors to make themselves familiar with the construction and working of the apparatus, and to satisfy themselves as to the excellence of their products by the proverbial method. The hall is tastefully decorated and comfortably lighted; it is not overcrowded, but nevertheless is well filled; the music is neither too loud nor too faint—in fact, we find nothing to criticise adversely, except that the Hall is hardly large enough, and we are all the more pleased to be able to offer our sincere congratulations to the Electric Supply Publicity Committee when we remember that, but a few months ago, we were obliged to comment severely upon its total failure at Olympia. The contrast could hardly be more complete; we can almost say that everything that was done by the Committee at Olympia has wisely been avoided at Islington, and nothing that has been done at Islington was done at Olympia.

Some allowance must be made for the lack of counter-attractions, for it must be admitted that there is no other exhibit at the Agricultural Hall that can be classed in the same category as the Electricity Hall, from the point of view of the ordinary householder; but even had it been set down in the Electrical Exhibition, it would have held its own. Its situation is admirably chosen, for the visitor is attracted both on entering and on leaving the Exhibition, and as the sensible plan has been adopted of charging only for tickets actually presented at the turnstile, the supply authorities and exhibitors are distributing tickets broadcast. Some of the former are sending them in pairs, and this is undoubtedly a wise proceeding, which will greatly increase the attendance.

A visit to the lecture hall and restaurant of the gas companies at the other end of the Main Hall only adds to the gratification of the electrical enthusiast, for the enclosure is by no means attractive, and the restaurant, for obvious reasons, is *not* in the same room as the gas cookers. There is, however, a large collective exhibit of gas cooking and heating apparatus in the Main Hall. The gas companies have been freely circularising their customers with regard to the Smoke Abatement Exhibition; that is so much the better for the electrical suppliers, for the impressions left on the mind of the visitor by the respective displays cannot fail to be heavily in favour of the Electricity Hall.

A feature of the exhibits, the significance of which should not be overlooked, is the fact that several firms, whose names are literally household words in connection with coal and gas heated cooking apparatus, have found it desirable to establish departments for the construction of electric cookers. Their vast experience in connection with the culinary art cannot fail to make itself felt in this comparatively new line, and we look for material improvements in the design of electric cookers as a result of their entry into the business. Electrical engineers have tackled the subject with a courage deserving of the highest praise, but it was not humanly possible for them intuitively to recognise all the niceties and needs of the art of cooking; consequently they have had to tread the painful path called "learning by experience." But they have proved apt pupils, and with the aid of their knowledge thus acquired, and that of the newcomers into the business, they will soon be able to produce designs combining all the best features of the various models now available, and thus hasten the general adoption of electricity for cooking.

Large Turbines.

Elsewhere we record an event which we may fairly regard as marking an epoch in the triumphant progress of the steam turbo-generator—the placing of an order for a set of 25,000 kw. continuous output. Those of us who remember the time—as it were yesterday—when we exhibited complacent pride in the successful construction of a dynamo of 250 kw., and earnestly discussed the relative advantages of two-pole field magnets and of the multipolar designs which were then forcing their way to the front, are perhaps in a better position to appreciate the extraordinary progress that has been made in this department of electrical engineering than our younger colleagues. In those days we were only recently emancipated from the conditions graphically described by Mr. Swinburne as the sealing-wax and postage-stamp edging stage of development; the smooth-core armature still successfully held its own against the slotted drum, and carbon brushes were hardly known. Indeed, the litigation regarding the patent rights over the self-exciting compound-wound dynamo was still in progress—a sure indication that we were in the earliest stages of the art; and we thought a 250-kw. dynamo a very fine achievement.

Now, we hear without surprise of a machine with an output 100 times as large; we all knew it would come before long. As a matter of fact, we hardly realise exactly what 25,000 kw. really means; the figures convey little definite information to our minds. But we cannot fail to recognise the importance of the event, and we are glad to know that the firm of Sir Charles Parsons, to whose genius we owe the reaction turbine, will have the pleasure of constructing the first machine of this great output.

The Domestic Consumer.

Judging by the full attendance and extended list of speakers—many of whom did not get the chance to speak—at the informal meeting of the Institution of Electrical Engineers last week, it is quite evident that that body has taken the

cause of the domestic electrical consumer very much to heart.

An informal discussion is somewhat of an innovation at the Institution; this method of procedure has, however, met with much success in other directions, and the meeting on Thursday week more than justified the Institution authorities in making the departure.

In view of the avowed aim of the meeting, and the various factors which determine the success or otherwise of the movement to extend domestic electricity supply, it may be interesting roughly to analyse the speakers on that occasion. For instance, the consumer was ably represented by several speakers, although the opinions expressed on his behalf were certainly not more striking than many which have appeared in our own pages. Then, again, the views of the supply engineer were fully given; but they are well known, more particularly as regards the municipal engineer's sphere of labour.

The electrical manufacturer, on whom so much depends in this connection, took no appreciable part in the proceedings save for an endeavour to saddle the supply engineer with responsibility in the matter of cheaper units.

This was a disappointing feature of the discussion, in which the comparatively costly nature of electrical cooking apparatus was admitted, as well as the lack of up-to-date commercial facilities for obtaining it on hire. It seems obvious that, however efficient and economical in subsequent use a piece of apparatus may be, comparatively high first cost is the most certain thing to hinder its general adoption. In the interests of the industry, it might even pay at the present time to sacrifice some portion of this subsequent economy—which the average purchaser cares very little about—if this will enable us to manufacture on standard lines at a reasonable and competitive figure.

We are afraid that the manufacturers, like certain supply undertakings, are content to skim off the cream of the domestic consumers' business, deferring indefinitely the day of the small consumer—the class above all others which has made the gas industry what it is to-day.

Payment of Dividend out of Capital.

Dividends presuppose profits of some sort, but the word profit is by no means free from ambiguity. The law is more accurately expressed by saying that dividends cannot be paid out of capital, than by saying that they can only be paid out of profits. The last expression leads to the inference that the capital must always be kept up and be represented by assets, which if sold would produce it; and this is more than is required by law. Perhaps the shortest way of expressing the distinction is to say that fixed capital may be sunk and lost, and yet that the excess of current receipts over current payments may be divided; but that floating or circulating capital must be kept up, as otherwise it will enter into and form parts of such excess, in which case to divide such excess without deducting the capital which forms part of it, would be contrary to law. There is no law which compels limited companies in all cases to recoup losses shown by the capital account out of the receipts shown in the profit and loss account, although care must be taken not to treat capital as if it were profit. There is nothing in the Acts which prevents a company which has lost part of its capital from continuing to carry on business and declaring and paying dividends.

There is no law which prevents a company from sinking its capital in the purchase or production of a money-making property or undertaking, and from dividing the money annually yielded by it, without preserving the capital sunk, so as to be able to reproduce it intact either before or after the winding up of the company. When it is said that dividends are not to be paid out of capital, the word capital means the money subscribed pursuant to the memorandum of association or what is represented by that money. Accretions to that capital may be realised and turned into money which may be divided among the shareholders, as was decided in Lubbuck *v.* British Bank of South America.

Economic and legal profits have always been, and will always be, irreconcilable, and there is as much difference between them as there is between an axiom and a fallacy, or as there is between truth and falsehood.

Economically there is no doubt that large sums are paid away every year as divisible profits or dividends out of capital.

The legal *obiter dictum* which we have noticed is vividly brought before us in a recent case of the compulsory liquidation of a company which was only incorporated in 1910, and which in August last paid an interim dividend of 25 per cent. per annum, which the Official Receiver states in his report was paid out of capital.

Electrifying the World.

The electrification of the world is proceeding at a gratifying pace. To our mind, nothing can stay the progress of this development. The movement, once well begun, does not call for the same degree of effort to sustain it as was the case a few years ago. Facts and experience cannot conceal themselves in these days, therefore the advantages accruing from the success of electrical service, of whatever kind, make imitation and advance inevitable. We attach great importance to the testimony of a satisfied user in encouraging the domestic and industrial applications in any authorised area at Home; in a larger sense it is the selfsame influence which will compel extended electrical service in the vast areas abroad. The satisfied investor, too, anxious to repeat his experiences, may also be reckoned upon to render indispensable aid. In no awakening or developing country can progress proceed along the comparatively slow and difficult way that characterised foreign and colonial forward movements of earlier days. Electricity has altered all that. The pace is quickened and the way simplified. Water-power utilisation, telephonic and wireless telegraph communication, the automobile, are among the friends of the pioneer of the twentieth century.

In most places electricity has in the past been brought in, as scientific and engineering achievements have rendered it possible, to supersede some other agent. To-day it is recognised as *par excellence* the great handmaiden of the pioneer, and when we talk of the opening-up of great territories it is impossible to ignore the value of the assistance she can give. To the electrical mind these truths are patent enough; they are rapidly becoming common knowledge among general engineers, and to the financier the electrical way makes its irresistible appeal. Let the reader imagine, if he can, how much more advanced the present-day world would have been had electricity thirty years ago entered the field the full-grown servant that it is to-day. How vastly different must the progress have been in certain respects, and how much more rapid its speed! We mention the point as one of interest to everybody who is concerned with the grand work of peopling the great expanse of North America and utilising its natural resources, and to those who seriously consider the probabilities of the future in South America, in Africa, in Australia, in India, in China, whither the eyes of so many are wonderingly turning, desiring a greater scope for their own abilities and better opportunities for their sons, as well as a profitable sphere for their investments. The theme is one of fascinating interest; and while the practical observer is able to say what electricity has done and is doing to-day in supersession of other forces, it requires the fine imagination of a Ferranti to draw back the curtain and allure the secrets from the opening vista revealing the place that electrical application is destined to fill in practically every phase of life in countries where it begins with the beginner, and has not to compete with and rout methods and means that are already in possession.

RAILLESS TRACTION AT LEEDS AND BRADFORD.

Railless trolley 'buses have now been in service for nearly nine months in Leeds and Bradford, and, though we must wait little longer for complete financial accounts of the results of their working, various interesting results and changes in practice have followed from the experience already gained. By the courtesy of Mr. J. B. Hamilton, manager and engineer of the Leeds Tramways, and of Mr. C. J. Spencer, manager and engineer of the Bradford Tramways, our representative was recently enabled to collect the following

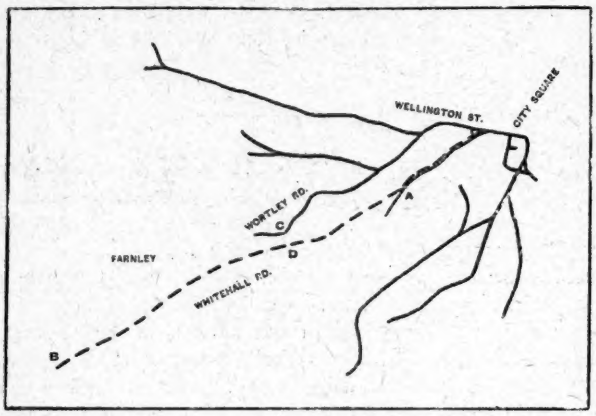


Fig. 1.

information concerning constructional developments, the past working of the trolley 'buses in these two cities and the future prospects of the system in each case.

In our issue of July 7th, 1911 (pages 22-23), we described and illustrated the chief features of the Leeds and Bradford installations. It will be remembered that the Leeds route, about 4 miles long, reaches from City Square to Moor Top, *via* Lower Wortley and Farnley (fig. 1), while the Bradford route is only 1·25 miles in length, and connects Dudley Hill with Laisterdyke, *via* Sticker Lane. Geographically both routes are easy, the most serious grades being 1/15 in Bradford and 1/20 in Leeds. By far the sharpest curve negotiated is at the acute junction of Wellington Street and Whitehall Road (Leeds), where the 'buses turn at a radius varying from 14·5 to 19·5 ft. The width of the streets traversed averages 33-35 ft. in both cities, so that the 15-ft. right or left deviation from the trolley wires, allowed by the 17-ft. trolley booms, is amply sufficient.

From a traffic standpoint, the districts served are barren. The Leeds route traverses poor quarters inhabited mainly by workers in the adjacent ironworks. There are rural sections on the route and near the authorised extension of the latter to the city boundary, so that the improved travel facilities now provided will doubtless lead to a certain development of the neighbourhood, but there is no hope of a radical amelioration of the latter. The existing population is poor, and except on Saturdays there is little traffic to be handled. The Bradford route operates under yet more unfavourable conditions. Though it undoubtedly meets a need by cross-connecting two radial tramway routes out of Bradford, it traverses a very poor district, and is of such short length that little regular traffic can be depended upon.

The running costs on each route may be regarded as typical, but the revenue obtainable is exceptionally low in both cases, so that, financially, the trial of the system is exceptionally severe.

Four 'buses are at present in service in Leeds and two in Bradford; all are by the Railless Electric Traction Co., and are equipped with Siemens motors and controllers. An average schedule speed of 8 m.p.h. is maintained on the Bradford route, while in Leeds, the double journey (8·5 miles), is performed in one hour, including all stoppages *en route* and the schedule stop of 5 min. at each terminus; the maximum running speed attained by the Leeds 'buses is 16 m.p.h., and the average schedule speed is from ½ to 1 m.p.h. higher than that of the trolley tramcars.

The Leeds railless vehicles maintain a regular service from from 8 a.m. to 10.30 p.m.; on Saturdays, three 'buses are in use (20 min. service), but, on other days, one 'bus runs till noon and two thereafter (1 hour and half-hour services respectively). On the Bradford route, only one 'bus is normally in service, maintaining a half-hour service from 5 a.m. to 11.30 p.m. On Saturday, both 'buses run, thus providing a quarter-hour service.

Up to and including December 31st, 1911, the Leeds 'buses ran 36,699 revenue miles, and the total number of passengers carried during this period was 149,333. During the same period, the Bradford vehicles ran approximately 18,000 miles, but full statistics are not yet available. The Leeds 'buses carry meters, but in Bradford the trackless trolley wires are fed through special meters located in street pillars at the two ends of the route. Whereas the energy consumption has averaged 0·87 unit per 'bus-mile (measured on the Leeds vehicles in dry weather), the Bradford 'buses have averaged 1·20 units per 'bus-mile (measured at the street feeder boxes).

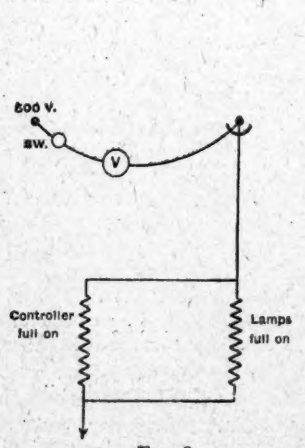


Fig. 2.

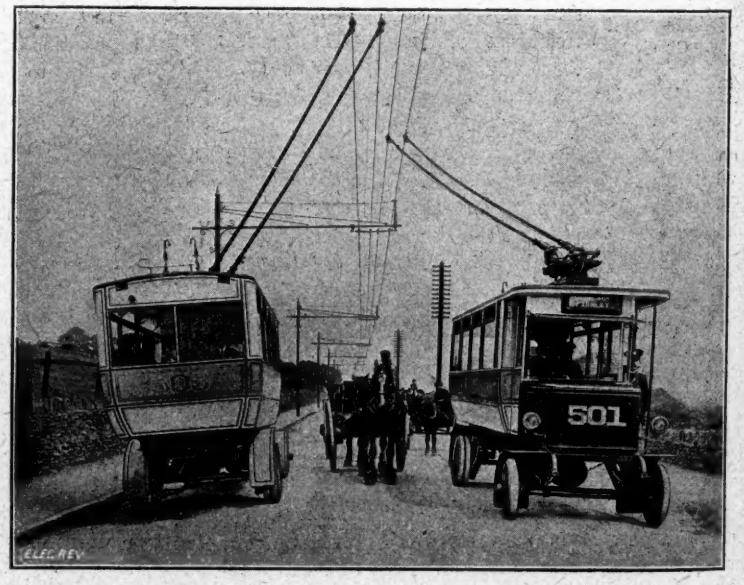


Fig. 3.—View Showing Front and Rear of Leeds Trolley 'Buses.

The Leeds vehicles as originally placed in service were undoubtedly under-tired (4·5 in. and 8·5 in. tires being used), with the result that tire maintenance exceeded 2d. per 'bus-mile for some time. Heavier tires (5 in. and 9 in.), are now in use, and several well-known firms are willing to contract for tire maintenance at 1·5d. per 'bus-mile. Tenders for the contract maintenance of the Bradford 'bus tires range from 1d. to 2d. per 'bus-mile.

The overall running costs in both cities have been approximately 6·5d. per 'bus-mile, and as experience in working the vehicles enables correction of defects in the original construction, it is hoped to reach a yet lower figure.

Originally the through fare on the Leeds-Moor Top route was 3d., but this has lately been reduced to 2d. (an average of ½d. per mile, which is lower than all but "privilege" tram fares). A maximum revenue of 8·3d. per 'bus-mile has been reached under the old fares, but during the Christmas holiday week (new fares then in operation), the average receipts = 7·02d. per 'bus-mile, and, at more normal times, now fluctuate between 5·5d. and 6·5d. per 'bus-mile. In Bradford the fare for the 1·25 mile route is 1d., and an average revenue of 8·5d. per 'bus-mile has lately been secured (rising to 9·5d. and 10d. per mile during the Christmas week).

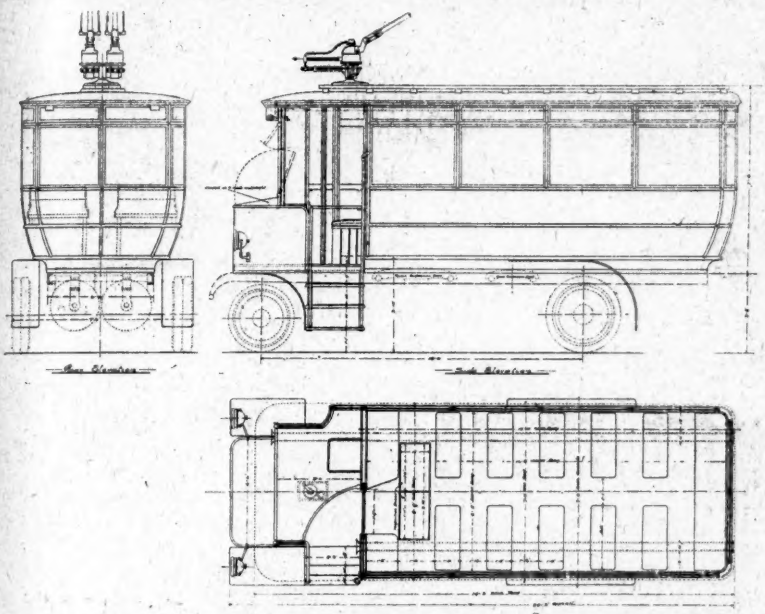


Fig. 4.—Latest Design, Leeds Trolley 'Bus.

In both cities the running costs have been as low as was expected, and so long as increased traffic does not raise the working costs by an amount approaching the additional revenue—a contingency which there is no reason to fear—the economic stability of the trolley-'bus is well established.

Life Data, Constructional Defects, &c.—It is yet too early to advance any definite opinion as to the mileage life of tires on trolley-'buses (though the above maintenance tenders give an approximate indication on this point). After nearly 40,000 and 20,000 'bus-miles respectively, it has not yet been necessary to take down any bearings on either the Leeds or the Bradford vehicles. The high gear ratio of 10 : 1, from the motor shaft to the road wheels, is obtained by an oil-immersed steel worm driving a phosphor-bronze worm-wheel, from the extended shaft of which a second reduction is obtained by an enclosed sprocket and chain drive. With the exception of a twisted worm shaft, broken during the recent snowy weather at Bradford, there has been no gear trouble reported, but in both systems considerable difficulty has been encountered with the chains. At Leeds, the spirally wound strips forming the roller bushes on the chains used, have been found to crack after a short time in service, and more serious damage then naturally follows. At Bradford $\frac{7}{16}$-in. roller chains have been employed, and have been too light for the work, so that breakages have been very frequent. The remedy is, fortunately, simple, a heavier chain being all that is required.

The steering gear of railless trolley-'buses is, of course, practically identical with that of petrol-driven vehicles, but at Leeds several weaknesses in the original design have appeared. The pin-holes in the rods have worn badly, a trouble which will be rectified by fitting hard steel bushes. In two cases steering rods have broken, fortunately without serious result; in one case the 'bus was under immediate control, while, in the other instance, the front wheels slewed round and the chassis sank forward till it touched ground.

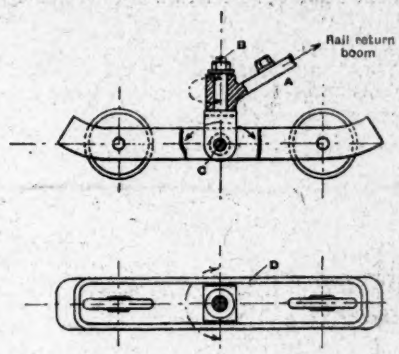


Fig. 5.

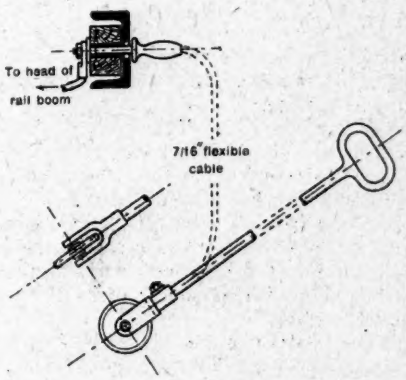


Fig. 6.

The only electrical mishap has been a short-circuit in the base of the trolley-boom of one of the Bradford 'buses. The motors (of the Siemens totally enclosed, shunted-field traction type), have given excellent results. On both systems, the insulation of the whole of the electrical equipment is tested daily, the method employed at Leeds being as indicated in fig. 2. The trolley wheel is placed on a length of specially erected, insulated trolley wire connected to the running trolley line through a voltmeter V, the reading v of which is related to the insulation resistance of the 'bus-circuits (controller and lamps full "on") by the following equation:—

$$R = \frac{(500 - v) \cdot r}{v} = \frac{500 \cdot r}{v} \text{ (approximately),}$$

where r = voltmeter resistance; v = reading of V in volts. This method of testing is simple and effective, and even with a dead short to the frame of the 'bus no damage can occur during testing (but v would then = 500 volts).

The insulation resistance of the Leeds 'buses (at 500 volts) was about 4 megohms when the vehicles were first placed in service. The best result now obtainable is about 2 megohms, and in wet weather the insulation falls to 500,000 or 250,000 ohms. The latter is the minimum at which the 'buses are allowed to remain in service, and corresponds to an earth current of 2 milliamperes. No shock can be felt at 500 volts through such a resistance.

Technical Notes: Constructional Improvements.—The Leeds trolley-'bus route follows the Whitehall Road tramway for about 1 mile, and then diverges, as shown in fig. 1. The remaining 3 miles of trolley-'bus route is fed entirely from the junction A, where also the negative wires are connected to the tramway track and to a negative feeder. The drop in the length A B of the trolley line averages 30 to 35

volts (two 'buses running), and rises to 38 or 40 volts as a maximum. The minimum line voltage available (at B) thus averages 430 volts at present, but it is proposed to increase this by running a negative feeder from the 'bus route to an adjacent tramway route near Lower Wortley (C D, fig 1).

The Bradford railless system is fed through 300-ampere Chamberlain and Hookham meters and double-pole switches and fuses in street boxes from the tramway feeders at each end of the 'bus route. The negative lines are similarly connected to the track return at each end of the route, and the

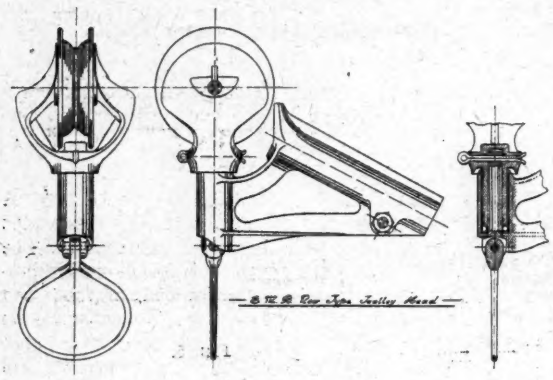


Fig. 7.

conditions, therefore, approximate the ½-mile sections usual in tramway practice. Recent tests showed 3·8 volts drop in the trolley line.

With the exception of the passengers' entrance, the general appearance of the 'buses on both systems is very similar. The Leeds vehicles, by their front entrance (see fig. 3) are certainly more handsome and snugger to ride in; the driver is able to see when passengers have finished alighting, and, in case of need, the 'buses could be managed by one man. Fig. 4 shows the general arrangement of the latest Leeds design, in which a number of small alterations have been introduced.

The Leeds cars have ordinary semi-elliptical plate springs; but in Bradford lever-spring shock absorbers have been fitted. Over frosty roads, both types of vehicle are fairly noisy in running, but in this respect and in general smoothness of riding, the advantage lies with the Leeds 'buses—mainly owing to the better road surface available. In neither case is any difficulty experienced in using high-voltage metallic-filament lamps for lighting the 'buses. It is important to note that the low centre of gravity of the vehicles, together with the twin back tires, has resulted in entire freedom from side-slip. Indeed, tests at Bradford, on greasy roads, showed it to be practically impossible to make the 'buses skid.

There have been some complaints of excessive mud-splashing at Bradford, which is hardly surprising, considering the weight and speed of the vehicles and the wretched nature of the road surface. Various patent splash-preventers have been tried without success, and the most practicable and satisfactory remedy appears to be a thin sheet of metal plate, hung vertically from the outside rim of the ordinary mudguard and provided along its bottom edge with a leather apron.

Both the Leeds and Bradford vehicles are at present heavier than is desirable, but by lightening the car body, the trolley boom, the motor shell (for the present ⅝ in. cast-iron shell is to be substituted a $\frac{5}{16}$ in. cast-steel shell), the rail skate and various minor parts, no difficulty is anticipated in reducing the weight of the 'buses to 4·25 tons, without unduly sacrificing strength. The tare weight of the Leeds vehicles is distributed between the front and back axles in the ratio 1 : 1·51.

The rail skates which are at present fitted to the Leeds 'buses to enable the latter to run on tramway routes, using the track return, are unsatisfactory in practice. Their design is complex, involving, as it does, a scraper, a metal brush, a guide wheel and a 20 lb. copper contact block. Though the skate boom enables a transverse movement of the 'bus 5 ft. on either side of the centre of the track, the "skate" is easily jerked out of the rail, and is specially liable to take the wrong route at points. The leading features of a new design by the Leeds Tramway Department are shown in the accompanying sketch (fig. 5). The boom A is free to swing round the vertical pin B which, in turn, can rock on the horizontal shaft C, carried in the frame of a small two-wheel bogie. The new contactor will weigh about half as much as the present model, and will ride the rails and points more securely.

During movements of the trolley-'buses in the car sheds, it is frequently necessary to work from a single trolley wire (using rail return), and it is then inconvenient to use the ordinary rail-skate (new or old design), with which it is difficult to move *across* rails. It is, therefore, proposed to use a portable rail skate for such work in the Leeds sheds. An insulated handle and stem (fig. 6) will carry a contact wheel, which may be placed on any track rail, and readily shifted as often as necessary. The U-frame carrying this wheel is to be connected by $\frac{7}{16}$ in. flexible cable to a plug fitting a socket mounted on the 'bus body as indicated. This socket will be connected to the head of the rail boom, ordinarily employed for track return purposes, and is covered-in when not in use.

A special type of trolley-head is now used exclusively on the Leeds railless cars (and to a considerable extent on the tramcars). As shown in fig. 7, the improvement consists in fitting a tail-piece and ring to the fork carrying the trolley-wheel, a small change which is, however, of great practical importance. The conductor's trolley-pole can be readily engaged in the ring on the trolley-head when lowering the boom (see fig. 8), and a simple means is provided for turning the trolley-wheel should this be displaced perpendicularly to the line. Hitherto there has been no definite means* whereby a displaced wheel could be turned round its pivot, and the

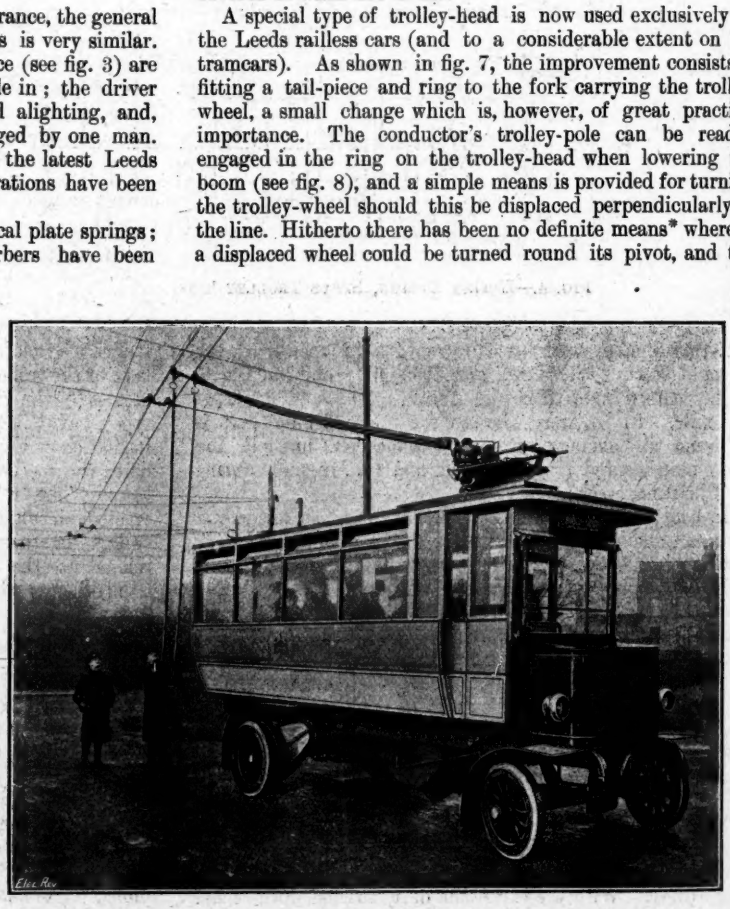


Fig. 8.—Manipulating the New Trolley Heads, Leeds Railless 'Buses.

time saved by the new device in this respect alone fully justifies its adoption. The ease with which hand poles can be hooked into the trolley-head rings makes this operation quite as expeditious as the use of permanently attached guide-ropes (such as are used at Bradford); if the least slack is

* Other than bumping the wheel against the trolley wire and attempting impossible marksmanship with a pliable 20-ft. pole.

allowed in the latter they constitute a serious menace to passing traffic.

The special line crossing, illustrated in figs. 9 and 10, has proved a simple but efficacious solution to a difficult problem. Proposals originally suggested involved 6 ft. cross-lengths of "dead" trolley-wire across which the 'buses were to coast. This necessity was specially objectionable, since the vehicles here enter a busy street. To provide for the not unlikely

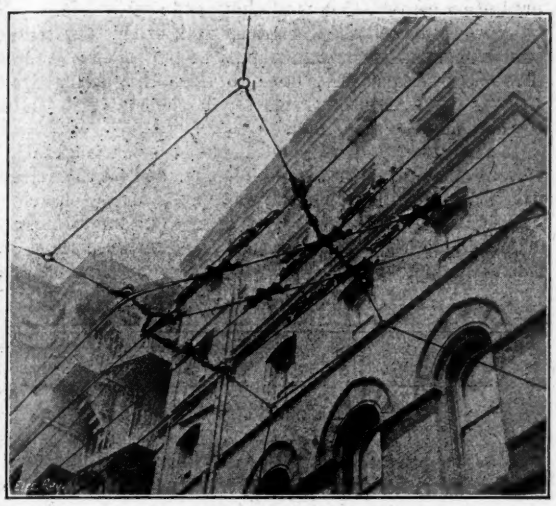


Fig. 9.—View of Special Overhead Crossing.

contingency of a 'bus being pulled up with its trolley wheels on the dead line, the latter was to be so arranged that it could be made "live" temporarily, from an adjacent street box. This scheme was very unsatisfactory, and is far surpassed by the present arrangement, which gives continuous supply, except at the section points shown.

On the accompanying diagram (fig. 10) ordinary solid cross-overs and frogs are employed, but, at the points A, their ends are built up as in section-insulator frames, and suitable lengths of fibre are held between two such ends or between one of the latter and half a standard section insulator, as the case may be. At this crossing, the standard spacing of the trolley wires (13·5 in. + to − and 9 in. + to +), is somewhat increased to make room for the special attachments required. Throughout the route, standard trolley poles with 16 to 18-ft. bracket arms are employed, and, on account of the greater number of lines carried, these are placed 35 yards apart (instead of 40 yards).

General and Extension Prospects.—So far as may be at present judged, the trolley 'bus has justified its adoption in both Leeds and Bradford. Further extensions are in immediate prospect in both cities, and neighbouring districts (*e.g.*, Rotherham), are erecting trial sections of railless route which, if satisfactory, will lead to rapid and

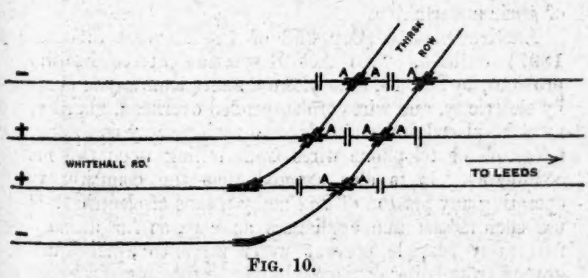


Fig. 10.

wide extensions. As compared with motor-'buses in the Leeds and Keighley districts, where running costs as high as 14d. per 'bus-mile are reached, the trolley-'bus is far more economical. Though it is only fair to state that these petrol vehicles are of old design, it appears that the trolley-'bus can compete favourably with the latest petrol-'buses, and has great advantages in smooth starting and speed changing (a factor which has great influence on tire maintenance costs). The roadside at regular stopping places on petrol-'bus routes soon becomes saturated with oil, which is most injurious to rubber tires.

A short motor-'bus route in Leeds, running outwards from the Headingley tramway terminus, is soon to be converted to railless electric traction, and the 12 miles of railless extensions embraced by the present Bradford proposals cover several radial routes to districts at present unserved by tramways (but in which the latter should soon be justified by the developments caused by trolley-'buses) and a number of link routes between existing tramway lines radiating from Bradford.

INTERNATIONAL SMOKE ABATEMENT EXHIBITION.

On Saturday last this Exhibition was formally opened by the Duke of Argyll, president of the Coal Smoke Abatement Society, at the Royal Agricultural Hall, Islington. The Duke referred to the fact that the coal strike was in progress as emphasising the need for economy of fuel, and adding to the interest of the Exhibition, which would do good service in demonstrating the methods by which that object could be achieved and the combustion of coal rendered less harmful to the public. Incidentally he praised the efforts of the Society to reduce the production of smoke, and pointed out that London had become almost free from fog during recent years, a result which was largely due to the operations of the Society.

A luncheon followed, at which Sir W. Richmond presided. Proposing "Success to the Exhibition," Sir W. Ramsay suggested that the work of the Society would be greatly simplified if no coal were burned at all. He proposed that gas should be generated in the bowels of the earth, by setting the coal on fire *in situ*, and blowing air down through boreholes to form, in contact with the hot coal, carbon monoxide gas, or air and steam to form water gas; the gas thus generated could be collected by means of concentric tubes and used to feed gas engines on the surface. These engines would drive generators which would produce electricity, and the latter could then be distributed to all parts of the country for lighting, heating, and power purposes. This system would utilise 30 per cent. of the energy of the coal, or twice as much as the steam engine, and the cost of electricity might be brought down even to one-hundredth of a penny per unit! Then there would be no need for miners, and the latter had better take care what they were doing, or they might lose their employment altogether. Sir W. Richmond, in responding, welcomed the suggestion, which, he said, illustrated the great truth that when the politician failed, the man of science must be called in to attack the question from a non-party but progressive point of view. The manufacturers were formerly blamed for the smoke nuisance, but the domestic fire was responsible for a great deal of it, and they must enlist the public in support of their movement. He rendered thanks to Mr. Bridges, the organising manager of the Exhibition, and Mr. Lawrence Chubb, secretary of the Society, for the successful promotion of the Exhibition.

Proposing "The Visitors," Dr. H. A. Des Voeux laid stress on the great improvement that had been effected in London during the past 30 years; but still, he said, 25 to 30 lb. of soot was deposited in London per inhabitant per annum, and it would be a very different place if that could be abolished. In his reply, Dr. W. N. Shaw, director of the Meteorological Office, stated that it had recently been found that sulphur compounds in the atmosphere were acted upon by sunlight, giving rise to haze and fog. Dr. Gough referred to the work done by the L.C.C. in the direction of smoke abatement, and Dr. Hill also responded. In proposing the health of the chairman, Prof. Meldola paid a well-deserved tribute to his efforts in the cause.

The Exhibition will be open daily from 10 a.m. to 10 p.m. until April 4th, and during this week a programme of conferences and lectures has been carried on in connection with it, at which many interesting papers and addresses have been read.

Apart from the special exhibit of the Electric Supply Publicity Committee, there is not a great deal of interest to electrical men in the Exhibition. Messrs. Bilbie, Hobson and Co. are showing their Hornsby Stockport gas engines. The Carron Co., whose cooking and heating apparatus are of world-wide reputation, have embarked upon the manufacture of electrical cookers, radiators, &c., and show on their stand an electric range which presents some interesting features. Mr. W. Whittaker shows coking stokers and a sprinkling stoker, and Messrs. Babcock & Wilcox, Ltd., exhibit their chain-grate stoker. The Union Electric Co., Ltd., show a model shop window lighted by the "'Union' Ideal Shop Window Lighting System." Messrs. Ozonair, Ltd., have a stand devoted to their apparatus for generating ozone; both fixed and portable types are shown, suitable for a variety of applications. Messrs. Edward Bennis & Co., Ltd., show no fewer than five "smoke abatement" exhibits, comprising two types of mechanical stokers (coking and chain-grate), with a bucket elevator and bunker and ash remover. Bean's Bunsen Smokeless Furnaces Co., Ltd., have an exhibit of their furnace, and Messrs. James Hodgkinson (Salford), Ltd., show an automatic coking stoker. Messrs. John Ruscoe & Co., Ltd., also show their "Tuto" mechanical stoker and elevator. Mr. Hjalmar Lofquist, of Stockholm, exhibits an electric automatic apparatus for heating water, in operation. Messrs. J. & P. Hill show the "Galloway-Hill" patent furnace.

The centre of interest at the Exhibition, however, is the "Electricity Hall" organised by the Electric Supply Publicity Committee. This has been tastefully decorated with mauve and white hanging drapery, palms, &c., and is well advertised by prominent electric signs; being close to the entrance of the Exhibition it cannot be overlooked, and hardly a single visitor can escape paying it a visit. The Electricity Hall is not divided up into separate stands; it is, however, classified into sections under the heads of cooking (and eating—there is a daintily furnished restaurant), heating, laundry and miscellaneous, of which the first-named is by far the most important. Here are collected electric cookers, boilers, hot-plates and other utensils representing the products of all the leading makers: Messrs. Purcell & Nobbs, the British Prometheus Co., Ltd., the Sun Electrical Co., Ltd., Messrs. Ferranti, Ltd., the General Electric Co., Ltd., Electric and Ordnance Accessories Co., Ltd., the Berry Construction Co., Ltd., Messrs. Benson, Messrs. Mabbott & Co., Messrs. Jackson, Mr. Bertram Thomas—all these firms have more or less apparatus on show, most of it being in use. The collection is unique, and of the greatest interest. Next comes the heating section, in which, as well as in the former, we find many of the above-named firms represented; here also are the Dowsing Radiant Heat Co., Ltd., the British Thomson-Houston Co., Ltd., the Edison & Swan United E.L. Co., Ltd., Messrs. Drake & Gorham, Messrs. Berry, Skinner, & Co., Messrs. Siemens Bros. & Co., the Metropolitan Electric Supply Co., Messrs. Spagnoletti & Co., and the City of London E.L. Co. The main feature of the laundry is the electric iron; and in the miscellaneous section we must add the names of Messrs. Causton, the Adnil Electric Co., Messrs. Mavor & Coulson, the Armorduct Co., and the Synchronome Co. to those given above.

The Hall is admirably arranged; at the entrance is the stall of the Committee, at which numerous booklets, brochures, pamphlets, *et hoc genus omne*, can be obtained. Beyond this on one side is the restaurant, with its inviting little tables, and at the end of the room the scullery, where some interesting electrical machines for peeling potatoes, cleaning knives, &c., are to be seen in use. Returning on the other side of the hall, we find the electric kitchen facing the restaurant, behind a counter on which are displayed various appetising dainties. The apparatus shown in this section was connected up by the Marylebone Electric Supply Department on the excellent system already mentioned in a recent issue, and includes cookers mainly suitable for ordinary households, as well as auxiliary apparatus such as hot cupboards, water boilers, &c. A large space is allotted to this exhibit, and visitors are welcome to examine the ovens, &c., which are operated by a staff of lady cooks who have been taught the use of the electrical appliances within the last fortnight. Needless to say, there are no nauseous odours, no suffocating fumes, in the neighbourhood of this *cuisine*; nor is the temperature high. Perfect comfort reigns, and hence it is possible to place the restaurant and the kitchen close together in the same room.

The heating section comes next, well filled with radiators and convecters of all sorts and sizes; and, lastly, the model laundry and miscellaneous sections close the circuit. There is also a tuneful but unobtrusive band—the Russian Balalaika Orchestra—in a corner, whose performance, without preventing conversation, is soothing and appropriate.

The lighting of the Electricity Hall is effectively carried out with metallic-filament lamps in bowls, and in Holophane cut-glass shades, close to the ceiling; the Union Electric Co.'s Excello flame arc lamps are used in the corridor and the main hall.

It should be added that demonstrations of the uses of the various electrical devices go on all day, and all the refreshments consumed in the restaurant are cooked by electricity, in view of the purchasers. Free tickets of admission can be obtained from the various electricity supply authorities, and it is to be hoped that there will be a very large attendance.

ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

(*Continued from page* 331.)

10. *Ontario.*—The revised statutes of Ontario which were published in 1897, contain "an Act respecting companies for supplying steam, heat, electricity, or natural gas, for heat, light, power." This Act provides (by Sec. 1) that any five or more persons who desire to form a company for supplying (*inter alia*) electricity in any city or municipality, may become incorporated under the Ontario Companies Act. Every such company may construct works for the production of electricity, and may conduct the same by any means through, under, and along the streets, highways and public places of the city, town, or other municipality; but as to such streets, highways and public places, only upon and subject to such agreement in respect thereof as shall be made between the company and the municipality, and under and subject to any by-law of the Council of the municipality passed in pursuance thereof. By Sec. 5 it is provided that no company shall be entitled by virtue of the Act, to take possession, or make use of, private property, or to do any work thereon under the compulsory powers of the company in that behalf, until the amount to be paid for or in respect of such property is ascertained by arbitration or otherwise, as the case may be, and is paid or tendered to the parties entitled thereto, or is paid into Court for their benefit. An electric light company may also lease their machinery when it is not in use, and they may lease the land which they use for the purpose of their undertaking.

Another Statute (Cap. 208 of the Revised Statutes of 1897) entitled, "An Act Respecting Street Railways," provides, by Sec. 18, that where a street tramway is operated by electricity, and wires are suspended overhead, guard wires must be placed and maintained in such a way as to prevent telegraph or telephone wires from falling upon the naked conductors. It is also enacted that the company when operating any portion of its line by means of electricity shall use such means and appliances as may, as far as may be reasonably possible, prevent water pipes, &c., placed underground from being damaged by the escape or discharge of electricity into the ground. For this purpose the rails must be properly bonded.

By the Municipal Act of 1897 (Cap. 223), it is provided that the local authorities may make by-laws for regulating the erection and maintenance of electric light, telegraph, and telephone poles and wires, within their limits.

By Sec. 566 of the same Act, it is provided that the Councils of the municipalities may make by-laws to authorise any gas or water company to lay down pipes or conduits for the conveyance of water or gas under streets or

public squares, subject to such regulations as the Council see fit; and by an amending Act which was passed in 1902 (The Municipal Amendment Act, 1902, 2 Edward VII, c. 29), similar provision was made in the case of electrical supply. It may be observed, in passing, that these Acts contain provisions which ensure that a supply shall be given to each consumer on equally favourable terms. It is also competent for those who provide the supply to demand security for its continuance from the consumer.

The Government of Ontario early became alive to the fact that they had in their great rivers which run through the colony immense stores of power, and that it was essential that the use of that power should be controlled by the Legislature. Accordingly in 1906 by "an Act to provide for the Transmission of Electrical Power to Municipalities," a body entitled the Hydro-Electric Power Commission of Ontario, was brought into being. While this Act, generally speaking, enabled the Commission to grant powers to municipalities, an Act which was passed last year (The Power Commission Act, 1911, Cap. 14), provides that any one or more of ratepayers in a municipality, the Corporation of which has not entered into a contract with the Commission under the Power Commission Act, may apply to the Corporation to obtain from the Commission a supply of electrical power and energy for the use of such ratepayer or ratepayers for lighting, heating, and power purposes, or for any of such purposes. Upon such request the Commission furnishes to the Corporation an estimate of the maximum cost per horse-power at which the electrical power or energy will be supplied and an estimate of the cost of providing and constructing transmission lines. The process of obtaining a supply of power is much simplified by the procedure under this Act. Thus, under a former Act a poll of ratepayers was necessary, but this may now be dispensed with.

11. *Quebec.*—There does not appear to be any special Act or Ordinance relating to the supply of electric light in the Province of Quebec. However, by an Act assented to on January 12th, 1895, it was provided that the provisions of the law concerning the organisation of gas and water companies should govern the organisation of electric light and water companies. It would thus seem that those who have power to legislate in Quebec have fallen into the error of legislating by reference, a procedure which has done so much to arrest the progress of electrical development nearer home. Turning to the ordinances so incorporated, it will be found that by Sec. 6 of Cap. III of the Revised Quebec Statutes (1888), provisions are set out under which gas and water companies may commence business. It is provided that any five or more persons who desire to form a company for supplying any city, town, incorporated village, parish, township or other municipality with electricity or water, or with both electricity and water, may make and sign a statement or declaration in writing in which shall be set forth :—

(1) The corporate name of the company; (2) the object for which the same is formed; (3) the amount of the capital stock of the company, which shall be divided into shares of $20 each. The company so incorporated may sell or hire out meters and fittings. They may break up streets for the purpose of laying mains and pipes, and may even pass through or under the property of one person to reach that of another, provided, of course, that in this, as in other cases, they make satisfaction for all damage which may be done. Their works must also be carried on with due regard to public public safety. With regard to the laying of cables, the company has powers similar to those which are conferred upon telegraph companies. Thus, "it may construct the lines of telegraph designated in its certificate, upon any lands purchased by it, or the right to carry its line over which has been conceded to it by the parties having a right to make such a concession, and along any and upon any of the public roads and highways, or across any of the waters within this province by the erection of the necessary fixtures, including posts, piers or abutments, for sustaining the cords or wires of such lines, provided the same are so constructed as not to incommode the public use of such roads or highways, or to impede the free access to any house or other building erected in the vicinity of the same, or to interrupt the navigation of such water."

12. *Nova Scotia.*—The Nova Scotian Government, in the matter of electric lighting, have apparently contented themselves with placing a restriction on prices. Thus, by "an Act to Regulate the Prices of Electric Light and Energy, 1907 (7 Edw. VII, c. 40)," every person, firm and company, and every city or town carrying on the business of furnishing electric light or energy, must file in the office of the Provincial Secretary a schedule of the prices charged for electric light and energy. The Governor may, upon application, alter, reduce, or modify the charges. To take or collect charges higher than those contained on the file is an offence for which a person is liable to a penalty of not less than $50.

13. *Cape Colony.*—The only Act in force in Cape Colony on the subject under discussion is an "Act for Regulating the Employment of Electricity for the Purposes of Electric Lighting and Power Generally," which was passed in 1893. The provisions of that Act apply to every local authority, company or person, supplying or employing electricity for any public purpose, within any area, who may be authorised by an Act of Parliament, or to any company or person who may, with the consent of any local authority, and the approval of the Governor, be empowered to supply or employ electricity for any public purpose within any area, and shall apply to every undertaking so to supply or employ electricity.

Sec. 2 provides that "the Governor may from time to time make such regulations in accordance with the regulations for the time being of the Board of Trade of the United Kingdom, subject to such modifications as he may think expedient, but in no case more stringent, for securing the safety of the public from personal injury, or from fire or otherwise, and for minimising, as far as may be reasonable, any interference with the electric wires and apparatus, and lines of the Government or any other authority, company or person, and from time to time rescind, alter or repeal such regulations.

Sec. 8 provides that any local authority duly authorised thereto, and any company or person having received the necessary consents intending to apply for statutory powers to enable them to supply electricity for any public purpose, or use it as a motive power in connection with tramways, shall give three months' notice of such intention to the Government, and must also advertise the fact of their application in the papers.

14. *Ceylon.*—In 1895 the Government of Ceylon passed an Electricity Ordinance to provide for the protection of persons and property from the risks incidental to the supply and use of electricity for lighting and for other purposes.

The Ordinance of 1895 was repealed in 1906 by the Electricity Ordinance (No. 26) of 1906, which, by Sec. 5 (1), provides that no person shall supply energy for electric traction or to the public for any purpose, except under and in accordance with the terms and conditions of (*a*) a licence granted by the Governor; or (*b*) a licence or concession granted by a municipal council and authorised by the Governor, with the advice of the Executive Council. There is a proviso exempting those affected by contracts in force when the Act came into operation. The section goes on to provide that no person shall for any purpose in any street, alley, or lane, or in any vessel, factory or public place use energy which is not supplied to him under a licence as aforesaid without giving seven clear days' notice to the local authority. By Sec. 6 (1) the Governor may license any person to supply energy for any purpose in any specified local area, and also to lay down electric supply lines for the conveyance and transmission of energy from a generating station situated outside such specified local area to the boundary of such area in any case in which the energy to be supplied is to be generated outside the local area. The Governor may cancel a licence or place the licensee upon further conditions and restrictions in case he is guilty of a breach of the conditions of his licence; becomes bankrupt or insolvent; or where the licensee shows the Governor that the undertaking cannot be carried on except at a loss. The law is apparently rigorously enforced, for by Sec. 10 if a person supplies energy either to the public or for traction without obtaining a licence or concession as required by Sec. 5 (1), or uses energy supplied otherwise than under the provisions of Sec. 5 (1), without giving notice required by Sec. 5 (2), he is punishable with a fine which may extend to 500 rupees.

15. *Jamaica.*—The supply of electricity in Jamaica is controlled by a law which was passed in 1890, *sub. lit.* "The Electric Lighting Law, 1890." This measure seems to be founded on the English Electric Lighting Acts. It provides (by Clause 2) that the Governor in Privy Council may from time to time license any local authority as defined by the law, or any company or person, to supply electricity under this law for any public or private purposes within any area, subject to certain provisions. The "local authority" means the parochial board of the parish within which the licence is sought to be obtained. The consent of every local authority having jurisdiction within the area, or any part of the area, within which the supply is to be licensed to be furnished, is required as a condition precedent to the application for a licence. The local authority are authorised to give such consent, subject to the approval of the Governor in Council. In addition to the by-laws which the Governor may make for the purpose of carrying the Act into effect and securing the safety of the public, the local authority may make by-laws and provide penalties for their breach.

There is a provision for compulsory purchase of any undertaking by the local authority upon terms precisely similar to those of the Electric Lighting Act, 1888.

(To be concluded.)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Diesel Engine Trials.

We note that in your issue of March 22nd, it is suggested in reference to the trial made by Messrs. Barclay, Curle & Co., of Glasgow, on the Diesel engine made by them, which trial consisted of a 30 days' non-stop run, that this is the longest reliability trial of Diesel plant on record.

In reference to this point, we would say that a trial of this duration on Diesel engines is by no means exceptional, and not only is this the case as regards trials, but also many of our engines have run regularly for similar periods in actual service.

I might quote one instance of this, viz., the engine we supplied to the Birkdale Electricity Works close upon five years ago. This engine runs regularly for a month, and is then shut down for a few hours for cleaning, &c. Mr. Bentham, the engineer, recently presented a report to his directors, in which he gave the number of hours this engine had actually run in service since it was installed, and the figures showed that the engine had worked on load for an average of 23¾ hours out of every 24 since it was first started.

We do not bring up this point with any desire to depreciate the excellent performance of the Barclay-Curle engine, but merely to show that runs of 30 days' duration are not without precedent with Diesel engines, but in fact occur in regular practice.

Mirrlees, Bickerton & Day, Ltd.
CHAS. DAY, *Managing Director.*

Hazel Grove, *March 25th*, 1912.

[It should be remembered that the engine in question was of 1,500 B.H.P.—EDS. E.R.]

Earthing Mains.

In your note below my letter *re* the above, you state that the earthing regulation of the Board of Trade applies only to the neutral of a three-wire system. In Messrs. Dick and Fernie's new book on distributing systems they give an instance to show that it is advisable to earth the outer of a L.T. single-phase network fed from transformers, and in a note at the foot of page 195 they state that, according to the B. of T. regulations, the outer conductor of a concentric low-tension network should be *earthed* at the transformer.

Suppose outers were not earthed, a slight defect, such as the inner or + lead touching tubing, in the wiring of a house, would cause the inner of a distributing main to be at earth potential, and full voltage of supply to be between the outer and earth. The insulation between the outer and lead covering of concentric cables is usually not so high as between the inner and outer conductors, so that this reversal of the inner and outer would not be desirable.

Inquirer.

Large Currents at High Frequency.

To produce currents at high frequency—say, 2,000 per second—very high speeds and a large number of poles are used. The winding might be a single turn arranged zigzag. In such cases might not artificial cooling be adopted, where larger currents are required? In the case of a simple winding like that referred to, it might be in the form of a copper tube, and oil or air might be applied as the cooling media; this would probably multiply the output, as ordinarily obtained, many times.

W. H. F. Murdoch.

London, *March 23rd*, 1912.

Constantinople Telephone System.

In your "Telegraph and Telephone Notes" last week, referring to the telephone installation at Constantinople, there are one or two errors which I think it perhaps might be advisable to set right.

The rates themselves are not as stated in your Notes, but are as follows:—For private houses, £T5 for 500 conversations; for business exchanges, £T5.50 for 550 conversations.

The total cost of the works that are being installed will be nearer £250,000 sterling than the £125,000 you mention, and it is hoped that the exchange system will be opened and ready for use in about 18 months from now.

S. J. Goddard.

London, E.C., *March 21st*, 1912.

[We regret the errors pointed out by our correspondent; the Note, as indicated at the time, was derived from a French journal.—EDS. E.R.]

PARLIAMENTARY.

Brighton Tramway Proposals.

(*Concluded from page* 437.)

AT the resumed sittings of the Committee, MR. C. J. SPENCER, general manager of the Bradford Corporation Tramways, gave evidence in support of the scheme, and said that, having regard to his experience at Bradford, he considered that the estimates of the proposed Brighton system were reasonable. He corroborated the evidence of Mr. Hamilton to the effect that, wherever motor-buses could operate, so could trolley vehicles. In cross-examination, witness said a five-minutes service would be needed to carry the estimated traffic. Answering the CHAIRMAN as to whether he thought that railless traction would one day supersede tramways altogether, witness said he did not think that would be the case on broad roads, but it was an excellent substitute where the roads were too narrow for a tramway. On broad roads, he thought the tramway would always hold its own. Replying to further questions, witness said that the system at Bradford was installed as an experiment, but, being satisfied with it, they proposed extending it.

MR. J. M. MCELROY (general manager of the Manchester Corporation Tramways) expressed the opinion that there ought to be a through route between Rottingdean and Shoreham, operated by one authority. He considered the outside local authorities should own the system which was within their own districts, but that the Brighton Corporation should operate the whole.

MR. R. W. BARNETT, who represented a large number of property owners, addressed the Committee on their behalf, and urged that powers should not be granted in respect of Western Road.

A number of WITNESSES were afterwards called in support of the contention that property would be depreciated if the system was allowed in certain roads.

COLONEL YORKE, who was in attendance on behalf of the Board of Trade, was asked by the Chairman to give advice, and said the Board of Trade were of opinion that the circumstances concerning parts of the Western Road, North Street, St. James' Street, Upper St. James' Street, Bristol Road and St. George's Road, were such as to render the Board adverse to seeing any system of trackless trolley traction along the route. Answering Mr. Balfour Browne, Witness said the Board considered double-decked cars more dangerous than single decked, but there was no experience either in this country or on the Continent to guide them with regard to this. The double deck would increase the weight, and the Board had decided from the first that the weight of a car should not exceed 3½ tons un-

loaded or 5 tons loaded. Questioned by Mr. Lloyd, Witness said there was ground for objecting to a single-decked trolley car which would not apply to a motor-'bus, but he did not say there was a physical reason why the one should be more objectionable than the other.

Mr. Balfour Browne, K.C., then opened the case for the Hove Corporation Bill, which proposed to lay down a system of railless traction in the Borough of Hove and in the western districts beyond. He explained that neither the Corporation or the majority of the ratepayers desired to have such a system, but they were bound to admit there was a necessity for better communication through Hove into Brighton. They brought their Bill forward in self-defence, not only for power to run 'buses—which they wanted—but for the trackless system, in case the committee should consider that system was the right thing. Their contention was that the extra facilities required should be met by motor-'buses.

Mr. Barnett Marks (Mayor of Hove) was called and said they considered it would be most detrimental to Hove to have a trackless trolley system. If, however, the Committee decided there should be such a through system, then the Corporation wanted to be master in their own house, and hence they were seeking the power to provide the system from Shoreham to the Brighton western boundary. In that case there would be no difficulty in working with Brighton.

A large number of local witnesses were called, chiefly on the question of property depreciation.

Mr. W. H. Dawson, of Bradford, who had assisted Mr. Scott, the surveyor of Hove, in the preparation of the estimate, expressed the opinion that these were sufficient.

Mr. A. R. Fearnley (general manager of the Sheffield Corporation Tramways) said that his Corporation were now promoting a Bill for trackless trolley tramways. They had not many roads in Sheffield which would compare favourably with those of Hove. In cross-examination, Witness said if Hove preferred a motor-'bus service, he did not see why they should not have it.

Mr. A. C. Swinton, M.I.C.E., expressed the opinion that Western Road was unsuitable for a railless system, and he advocated motor-'buses in preference to the proposed system.

Mr. F. W. Keen addressed the Committee for the Portslade U.D.C. He said his clients were opposed to railless traction, and asked the Committee to reject the Bill of the Brighton Corporation, which he submitted was only brought forward to prevent the Tramway Co. getting the powers they were asking for. The introduction of the trackless cars would not be to the interests of the district, and the scheme presented two germs of self-destruction, viz., the narrow roads and the double-deck cars. The present 'bus service might not be perfect, but it was better than posts and wires on these narrow roads. He believed the 'Bus Co., if left alone, would improve its service to meet the needs of the district.

Evidence was then called in support of the position taken up by Portslade U.D.C.

Mr. R. Harker, who represented the Shoreham U.D.C., said that, after careful consideration, the local authority had come to the conclusion that a service of electric tramways would best meet their needs.

Mr. J. Flowers, on behalf of the Southwick U.D.C., opposed the Bills of the Brighton and Hove Corporations.

Mr. Wedderburn, K.C., addressed the Committee for the Omnibus Co., and said that if the Bill of the Brighton Corporation was going to be granted, his clients had nothing to say, as the Brighton Corporation had treated them fairly in the matter, but if the Hove Corporation were to be given powers to run motor-'buses in Hove, then he contended there should be some recognition of the 'bus company. Hove ought to give an undertaking to grant a lease to the company for a number of years.

Mr. Hutchinson opened the case for the Brighton and District Tramway Bill, and said that the reason why the tramway was in its present condition was simply because every effort made on its behalf had been thwarted by the local authorities. The British Electric Traction Co. acquired the tramway with the intention of equipping it electrically and extending it to meet modern needs, but at every step Brighton and Hove had opposed them. The promoters of the present Bill were gentlemen of very large experience in tramway undertakings, and if the Bill was passed they intended to form a company and to transfer the tramway to that company. The terms of the agreement by which the tramway could be acquired from the British Electric Traction Co. and handed over to the new company would be laid before the Committee and evidence given that the necessary capital would be forthcoming.

Mr. Stephen Sellon gave evidence in support of this scheme, and detailed the various attempts which had been made in the past to get Parliamentary powers to reconstruct and extend the existing tramways. He admitted that for certain purposes railless traction was useful, but in the case before them he considered it ill advised, and that it would involve a great loss to the Brighton and Hove ratepayers. To make an income of £16,500 a year in Hove, the railless cars would have to cover 744,000 miles a year, and that he estimated would mean a loss on the working of £4,650, to which interest and sinking fund and depreciation would have to be added. The proposal in the Hove Bill to remove the tramway he considered most unfair.

In cross-examination witness said the company had power to electrify the present line, but they were deterred from doing it because they could not get a satisfactory agreement with Hove regarding the purchasing period.

Questioned by Lord Ashton, witness said he did not think it was possible to run trackless trolleys over the same line as a tramway for any distance. In Leeds the railless trolley system started where there was a tramway and went over it for some way and then branched off.

Mr. Geo. Balfour, one of the promoters of the Company's Bill was called, and pledged himself to electrify the line if the Bill was passed. He had no doubt that the necessary capital would be forthcoming.

Mr. Freeman, K.C., addressing the Committee on behalf of the East and West Sussex County Councils, said that there was objection to either of the Bills proposed, and he asked the Committee if they were absolutely satisfied that any new developments were necessary, or were the whole needs to be met by leaving things in the hands of the present persons with a strong intention that the service must be improved. Whatever the Committee decided, however, he asked that there should be some contribution made to the cost of keeping up the roads affected.

Counsel appearing for the Hove and Brighton Bills also addressed the Committee in reply.

The Committee having adjourned to consider the matter, the Chairman announced that they had decided not to approve of the preamble of the Bill of the Tramway Co. With regard to the other two Bills, they considered it a matter for regret that the two Corporations had found themselves unable to promote a joint scheme. The Committee approved of the principle of the system of a continuous railless traction route under one management between Brighton and the western boundary of Hove. They approved the preamble of the Brighton Corporation Bill, with regard to that portion within their own boundary, and also the preamble of the Hove Bill, so far as it was within their own boundary, and they hoped it would be possible for the parties to arrive at some satisfactory arrangement.

Mr. Balfour Browne said he had no doubt after the intimation from the Committee some arrangement would be made between the parties.

The further consideration of the Bills was adjourned to allow of the necessary adjustments being made before the clauses were considered.

Metropolitan District Railway Bill.—Last week a Select Committee of the House of Commons, presided over by Sir Luke White, considered this Bill, which gives power to the L. & S.W. Railway Co. to widen their existing Wimbledon and Fulham Railway, and to enter into arrangements by which the District Co. will have the exclusive right of running over the widened lines when completed. There were also clauses relative to the constitution of the Power House Working Committee, which was set up under powers obtained last session. Evidence having been given, the Bill was reported for third reading.

Second Reading.—In the House of Lords on March 20th, the Loch Ericht Water and Electric Power Bill was read a second time.

LEGAL.

Schwartz *v.* The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

This case, heard in the Court of Appeal by the Master of the Rolls and Lords Justices Fletcher Moulton and Buckley on an appeal from an award of the Judge of the Woolwich County Court, raised a novel and interesting point in relation to the operation of the Workmen's Compensation Act, and decided the question as to whether, for the purposes of the Act, employment on board a British ship at sea could be regarded as employment within Great Britain.

From the statement of counsel, Mr. Knocker, who appeared for the applicant, a widow, who sought compensation for the loss of her husband, it appeared that the deceased, who was an electrical engineer, had been in the employ of the respondents, and, amongst other things, it was his duty to lay electric cables. In December, 1910, he was ordered to go to Teneriffe to lay cables there, and the ship in which he went was lost with all hands in the Bay of Biscay, and the question was whether the employment of a man on a British ship brought him within the operation of the Workmen's Compensation Act. There was no question that the accident was one which arose out of the employment, and the sole point was whether British territory included British ships, and if so, did it enable a man killed on such a ship to come within the Compensation Act. According to the authorities, a man on board a British ship was held to be on British territory, and if it were not so, there would be no law at all for the man whose employment took him to sea on such a ship.

Lord Justice Fletcher Moulton said that from Section 7 of the Act it was clear that it was not intended to include ships as part of the ambit of the Act, and the Court had to construe the Act as a whole.

Lord Justice Buckley said that Section 7 had special reference to seamen who, but for that Section, would be outside the Act altogether. Section 7 said that a seaman might recover notwithstanding that he was at sea on a British ship.

Mr. Knocker said that if a British ship was, for criminal purposes, British territory, in the absence of Sec. 7, the Act would apply to this case. This case had nothing to do with Sec. 7, which was only introduced for the benefit of seamen. The deceased was a workman who happened in the course of his employment to be on a piece of British Territory which brought him within the Genera Statute law.

Lord Justice Fletcher Moulton: The ship went down with all hands, and we don't know anything about the death.

Mr. Knocker said that a number of facts had been agreed, and the finding of the Board of Trade inquiry had been accepted. The deceased man was not a seaman, and Sec. 7 did not apply to him.

Lord Justice Buckley said that Sec. 7 said that a seaman was entitled to recover compensation for accident, and the deceased not being a seaman was not entitled to recover.

Mr. Knocker said that Sec. 7 simply extended the ambit of the Act. It was an extending and widening section and was unfairly used as an excluding section.

Lord Justice Fletcher Moulton said he did not remember any case under that Act or any other Act in respect of which a claim was made for accident on board a British ship.

Mr. Knocker said he agreed that there was no such case.

Lord Justice Buckley said that British ships were not included in the territorial limits for the purposes of the Act.

Mr. Knocker said that the law of contract or the Sale of Goods Act would apply to British ships.

The Master of the Rolls said that the deceased man was in the service of the respondents as electrician, and was sent out by them to take part in the laying of a cable to be paid so much per month while at sea, and so much a month while engaged in the work. There, therefore, was no question as to his having been employed by them at the time he lost his life, and his widow now said that she had a right to compensation under the Act. The accident was admitted and the employment was admitted and it might be assumed the accident occurred in the course of the employment. The applicant, however, was met by the difficulty that the case did not come within the provisions of the Act. Section 7 was not a provision for every one on board a ship, but only for seamen—the crew of the ship. It was impossible to hold that because a special section of the Act conferred upon a certain class certain rights, that every man who was injured on board a ship was entitled to claim compensation. Having regard to Section 7 of the Act he could come to no other conclusion than that the view taken by the County Court judge was right and that the appeal must be dismissed.

Lord Justice Fletcher Moulton agreed, and Lord Justice Buckley also concurred, observing that in his opinion a British ship for the purposes of the Act did not come within the territorial limits.

The appeal was accordingly dismissed with costs.

Street Accident Claim.

At Leigh County Court, last Friday, the hearing was continued on the action brought by George Gorse, who claimed £100 from the South Lancashire Tramways Co. for personal injuries. The plaintiff, who was a spinner at the Howe Bridge (Atherton) Mills, at half-past nine on the evening of June 15th last, it then being dark, was going along Leigh Road, Atherton, when he caught his foot on a manhole and fell heavily on his right hand, and his arm become practically paralysed. Mr. Acton submitted that the company were not liable. The work was done under the superintendence of the Atherton District Council, and approved and passed by the Council's surveyor. That was the limit of the Tramways Company's obligation, and if there was any actionable negligence the persons responsible were the District Council. His Honour reserved judgment.

The Postmaster-General and The National Telephone Co.

The National Telephone Co. applied to the Railway and Canal Commission, composed of Mr. Justice A. T. Lawrence, the Hon. A. E. Gathorne-Hardy, and Sir J. Woodhouse, to fix a date for the hearing of the arbitration provided for under the agreement between them and the Postmaster-General, by which the Post Office acquired the company's undertaking.

Sir Alfred Cripps, K.C., who made the application, said that the matter was a very heavy one, and many millions sterling were involved. The hearing must take a considerable time. The company were preparing certain particulars of their claim, and they would give the Postmaster-General as much information as they could. They had agreed to give him not only the items of their actual claims, but also the original figures on which the discounts had been made. He had had the opportunity of consulting with the Attorney-General (Sir Rufus Isaacs, K.C.), and they were agreed that the case should be taken immediately after the Whitsuntide recess, so that it might be finished before the Long Vacation.

The Attorney-General, who represented the Postmaster-General, suggested June 10th as a convenient day for commencing the hearing, and Mr. Cripps assented to that date.

Mr. Justice Lawrence asked whether counsel could give him any idea of the possible length of the case?

Sir Alfred Cripps said that the company would compress their case as much as possible, but he did not think that it could take less than three weeks or a month.

The Attorney-General said it would seem that they had to face a stupendous undertaking, and it was very difficult to say how long it would take to complete.

Sir J. Woodhouse.—So far as you can see it looks like lasting until the end of the sittings?—The Attorney-General said that was so.

Sir Alfred Cripps said they proposed to take the case with regard to the plant first, the claim in respect of which amounted to between £15,000,000 and £16,000,000.

Mr. Justice Lawrence remarked that if they had to ascertain the value of items amounting to £15,000,000 or £16,000,000, it looked as if the arbitration would last nearer a year than two months.

Sir Alfred Cripps said he should be misleading the Court if he said the case would take less than two months. Besides the plant there were a number of other items and, he believed, some 60 or 70 compensation cases.

The Attorney-General said he hoped the Court would see its way to commence the hearing on June 10th and sit *de die in diem* until it was concluded.

Mr. Justice Lawrence said that it would be necessary for him to consult the Lord Chief Justice, as he had arranged to go on circuit in June, but the case should be commenced on June 10th if he could cancel his circuit arrangements.

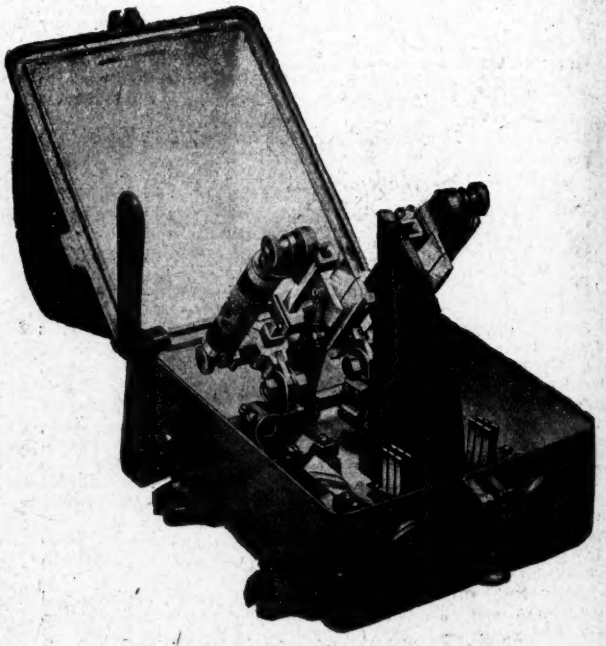
Coal Mines Regulations Act.

Wm. Robertson, pit fireman, 15, Park Street, Crosshill, was convicted on evidence in Dunfermline Sheriff Court, of having, in the Mary Pit, Lochore, used an electric cable which was less than 20 yards in length for the purpose of firing a charge, contrary to the Coal Mines Regulations Act, in consequence whereof he was injured by some of the material dislodged when the charge exploded. It was stated that Robertson had been entirely incapacitated for work since the accident in December last, and that a penalty was not desired, the case being brought into Court in order to enforce an important part of the Statute. As the man had already suffered so much, the Sheriff imposed no penalty.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

E.A.C. Switch-Fuses.

The Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.E., have just introduced a switch-fuse for heavy currents somewhat on the lines of their smaller design, but insulated throughout with mica, all live parts being clamped on to



E.A.C. Switch-Fuse (50-ampere size).

substantial mica-insulated steel bars. The switch has a quick break, and is interlocked so that the cover cannot be opened when the switch is closed. No combustible or hygroscopic materials are used, and the rating is liberal throughout. "Koolark" fuses are used. The interior of the switch is shown above.

The Coal Strike.—Messrs. W. H. Bailey & Co., Ltd., of Salford, issued a notice last week stating that they were well stocked with coal and most of the materials required for their works and foundries, so that there would be no stoppage.

COLONIAL REFERENCES.*

By COLONIAL.

Many engineers who have been in the Colonies have found, no doubt, on their return to England that the experience they have obtained abroad has not much weight at home, and also that engineers trained in the Colonies are not considered as good as men trained in the old country or on the Continent.

This is rather an interesting point, and there is much to be said on both sides; at the same time, it is an important question now that so many of our Colonies are going ahead in engineering matters, in some cases manufacturing their own goods. Many an engineer goes abroad for a few years, with the intention of ultimately returning to England, so that this matter is one which he must consider, in order that he may understand what his standing will be when he returns home.

One of our Colonies which is advancing apace in matters electrical, and opens tremendous possibilities for the electrical engineer, is United South Africa; a short description of the conditions and status of the engineer there may not be out of place, and will serve to show why Colonial experience does not count for much.

The root of the matter is that many Colonial engineers do not know their work, and are, in fact, only half-trained men, in some cases being absolutely untrained, merely self-taught, and not entitled to be called professional men at all; some such men are chief engineers and managers of engineering works, and as they control the work of those under them, it follows that the latter do not see things done in the manner in which they should be done, and consequently get into slack ways themselves, and get no up-to-date experience.

Many of these managers, borough electrical engineers, &c., are men who came to the Colony many years ago, and having absolutely no idea of modern methods, they run their works in the style that they were run in England, 10 or 15 years ago; this especially applies to central stations, some of which are an absolute disgrace to those in charge of them.

What chance, then, does a central-station engineer in South Africa have of obtaining experience which will be useful to him on his return to England? Can it be wondered that his Colonial experience is belittled? It can safely be said that one of these engineers, having been, say, five or seven years in the Colony, would be rather "at sea" in a modern central station, run on up-to-date lines.

It is not intended to imply that *all* the central stations in South Africa are obsolete, in fact many of them are quite modern; for instance, many of the new stations in the Transvaal have the very latest machinery, but it cannot be denied that things are often run in a very slip-shod manner, with an entire absence of discipline, and many of the engineers in charge of the plant do not understand or appreciate it.

Another reason for the non-recognition of Colonial experience, is the fact that the Colonial engineers do not in any way endeavour to maintain their status; they will be shift engineers to-day, and switchmen or glorified wiremen to-morrow, if they can get better salaries as the latter; it naturally results that the wireman class are shift engineers, &c., in time. How, then, can it be expected that the home engineers will attach importance to an engineer's Colonial references? He may be one of the glorified wireman type, in spite of his good references as an engineer.

It is no idle talk to say that there are many men in South Africa, glorying in the title of "Electrical Engineer," boasting of their A.M.I.E.E. (how they ever get it, Heaven knows), who, if the truth were known, are only wiremen or drivers, and have received no training whatsoever; in spite of this, they are, to all intents and purposes, electrical engineers, and are classed as such, even in some cases by the Government. These men, then, come home with their papers, the same as *bona fide* men; can it be wondered at that they are looked at askance? The genuine must suffer with the rest, since no weight can be placed on their papers, and there is no doubt that "paper experience" counts nowadays.

It must be admitted that many men who, on account of their poor qualifications, could never get a good position in England go abroad and manage to get what they cannot get at home. This must prove that the quality of the engineer in the Colonies is not up to the standard of the man at home.

These few points will serve to show why Colonial references do not avail much in England; what, then, is the remedy?

This question can be answered in a few words: "Raise the tone and status of the electrical profession in the Colonies."

How can this be done? In many ways; a few may be mentioned. First, the help of the Government must be obtained; they must define the term "electrical engineer," and institute a State Board examination, which will take the form of an ordinary examination in electrical and mechanical engineering—the mechanical section alone would weed out scores; they must also make genuine enquiries as to the candidate's training and experience, and pass an Act forbidding anyone to be employed in a position of responsibility who has not successfully passed the State Board; in fact, they must follow the example of the mining electrical engineers in the Transvaal.

Under these conditions, Colonial references, backed up by the State certificate, would be of value in England, and gradually the stigma attaching to them would disappear.

This would stop engineers from lowering their status by going as switchmen, wiremen, &c., for, naturally, an employer would look askance at an electrical engineer in possession of his certificate who had lowered himself and his profession in this way; whereas, at present nothing is thought of it, as many of the so-called engineers are in reality wiremen and electricians, and consequently dropping back to their real trade is lightly regarded.

Cases are come across where men are employed as shift engineers who never before saw a boiler in their lives; is this right, when so much damage and loss of life may be occasioned by their ignorance? The crux of the whole matter is that those who are in charge and who employ these men as shift engineers are not themselves capable; in fact, many of them would not be competent to take the post they are offering to others.

Municipalities are the worst in this respect; the councillors do not, of course, know anything about engineering, and get hold of men as their borough electrical engineers who are quite incapable of managing the department efficiently. It stands to reason that if good men are to get recognition, their chief must himself be a good engineer, so that he can appreciate their value and differentiate between them and the half-trained men.

The only way to impress upon municipalities the importance of choosing well-trained men to manage their electric supply departments is through the medium of the Press—in fact, a regular campaign is needed in all the leading newspapers, pointing out the advantages to themselves and the towns and cities generally.

There are many central stations which, run on up-to-date methods, could be made to pay, and pay well, instead of being a burden on the ratepayers. With prices ranging from about 6d. to 1s. per KW.-hour for lighting, 2d. to 3d. for power, and 1d. to 1½d. for traction, many works could be turned into veritable gold mines; whereas some of them make only small profits, or next to none, and in some cases they are run at a loss, simply because the chief knows nothing, either from an engineering or a business point of view.

Some municipal supplies do *nothing* in the way of publicity, and many people in the towns hardly know that a power station is in existence.

It may appear that all this is away from the point, but these facts are mentioned to show that the central-station industry is rotten to the core, especially those owned by the municipalities, and consequently the profession must suffer. If the concerns are not financial successes, then they cannot afford to pay good men; consequently the half-trained men are taken on and considered cheap! Then the confusing of the engineer with the "amateur" begins. All this

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* This article has been sent us by a young engineer who has acquired experience in central stations, both in South Africa and at home. While we disclaim responsibility for the views expressed, we believe they will be of interest to our readers. Probably there is another side to the question, and we shall be glad to receive communications from those acquainted with it.—Eds. E.R.

can be traced to the incompetency of the chief. If a few statistics of some of these stations were looked at, the figures would be appalling to the home engineer—12 to 14 lb. coal per KW.-hour, &c.; the chiefs take no steps to alter it, and the Councils do not know any better.

It may be asked why the engineers concerned do not remedy matters; the answer is easy—they cannot. They say their plant is out-of-date; in many instances it is, but it could easily be improved upon and "modernised," or, better still, replaced by up-to-date machinery. They will say that their committees will not sanction the expenditure —why? because the engineer is unable to prove to them the advantages, and consequent saving; it is beyond him. And so things go on in the same old way, and the chief bluffs the Council and keeps his post!

In some parts they are waking up somewhat, and importing men from home, in some cases with success, but very often the wrong men are brought out, simply because the chief does not know a good man. The log books of some stations would form an excellent "funny book" for Home engineers; thousands of figures may be seen, but what they are there for, no one knows; if they were asked how many lbs. of water they consumed per KW.-hour, or boiler-hour, or their KW.-hours per boiler-hour, &c., they would look puzzled, and shrug their shoulders.

Ask them to show cards from their engines, the results of boiler and engine tests, their coal analyses—few could do so; their coal is cheap (?), that is about all they know. May be, some engineer, a little more enlightened then his brothers, reads that turbines are more economical than his ancient reciprocating sets, or he thinks they would be; he decides to recommend his Council to sanction the necessary expenditure; he knows nothing about them, probably has had nothing to do with them, but still decides to install them without taking the trouble of going into the matter and estimating the saving, taking capital charges, sale of old plant, installing of superheaters, extra vacuum required, &c., into account, and probably ends up by being in a worse state than before.

Before installing them, his experience consists of taking an assistant with him and *seeing* someone else's plant running. This will show what stamp of men some of the chiefs are in South Africa, and the consequent class of men under them. Can it, then, be wondered at that Colonial engineers' papers are of little avail in England when the profession is in this state?

There are many good engineers in South Africa, but what can they do under chiefs of the stamp outlined? They must keep quiet and say nothing, whereas, were their advice taken, great improvement would result.

Engineering is a great and important profession, and the electrical section will be of the utmost importance to South Africa, and in the development of the country; so let each member of it do what he can to raise the status of all connected with it.

The South African Institute of Electrical Engineers has done yeoman service for the mining section and obtained at least some recognition for the electrical engineer at the mines; but there is yet a far wider field open for it in the raising of the standing of the electrical engineer all over South Africa and getting him to realise his own responsibility in the matter—not to allow himself to be classed among the wireman-engineer type, and to refuse to accept a position beneath his status because it happens to be more lucrative. The engineers must stand together to retrieve their position before it is too late, and then, and only then, will their Colonial references carry any weight at home.

Prices Advance.—The Western Electric Co., Ltd., announce that, in view of the increase in the cost of raw materials, the prices of batteries and parts, battery material, bells, indicators, galvanometers, pushes (all classes), were advanced 10 per cent. on March 25th.

The General Electric Co., Ltd., have also issued notice of 10 per cent. advance on all prices shown in sections L of their catalogue.

The Sterling Telephone and Electric Co., Ltd., have likewise issued a notice of a 10 per cent. advance in prices appearing in the Bell Section of their catalogue (all items listed under initial letter "S"), with the exception of wires, insulators, ironwork and medical coils.

DEPRECIATION.

[COMMUNICATED.]

The necessity for, and importance of, making systematic and adequate provision for depreciation or renewals is being increasingly forced upon the attention of the administrators of electrical and other industrial undertakings.

We have only to look at the huge sums under construction and equipment and other nomenclature, representing expenditure in cash and paper, and incorporating in many instances goodwill and other descriptions of outlay, and to observe here and there the scant reparation for the perpetual loss which is ever in evidence, to obtain some idea of the vast primary importance of making due allowance therefor.

It is a mere truism to state that no profit can be deemed a true profit without giving effect to all losses applicable to the period for which the account of profit and loss is drawn; and as depreciation, wear and tear, or other synonymous idiomatic nomenclature is indicative of a certain loss, it should, as far as it can be approximated, form a debit against revenue, and should never be shown as an appropriation of so-called net profits, unless it be a provision in advance of the loss that has arisen and that will require to be sustained.

So-called net profits are in themselves merely estimated profits more or less, and to the extent that they are estimated, having regard to the intended continuous nature of industrial and other commercial ventures, it is sometimes stated that there is no such thing as net profit.

Now, if we take the assets side of an electrical or any other industrial balance-sheet, we shall find that the expenditure is of a diversified nature, from which we may comprehensively draw the following general characteristics from a disintegration and classification of its component parts.

In the first place, capital is usually held to mean anything which affords production or revenue, or which is a source of income.

Assumably the (1) legal capital of a company is that contributed to it by its proprietors, whilst economic capital of a company is the product of the use of the capital as represented by the assets and expenditure shown on the assets side of the balance sheet. Capital from an income-tax point of view is so full of anomalies as to be incapable of any satisfactory interpretation.

Broadly, capital expenditure is either of a fixed or circulating character. Fixed capital is that from the use of which arises revenue or production without change of owners, and circulating capital is that from which is derived revenue or production by parting with it or changing it.

These terms, though they may be ambiguous, merely serve the purpose of expressing what expenditure is of a fixed capital nature, and what expenditure is of a circulating capital nature. Their use does not imply that the sums which they represent are continuously fixed or circulating, as the case may be. We therefore have:—

1. Assets and expenditure employed in the service of earning revenue for the undertaking, and therefore of a live or active and producing character.

2. Expenditure which *per se* possesses neither present nor future value, and which, considered even in conjunction with or in the light of the context of the business, may be credited in many cases with a precarious tangibility.

Such expenditure should be afforded merely a temporary reception in the balance sheet because of the inequity that would arise if it were incorporated or sunk in the profit and loss account at one time, it being convenient to apportion the extinction in money of such book values over a course of years.

3. Expenditure unrepresented at present by any assets, physically or otherwise, which should be treated in a manner similar to that indicated in (2).

We are told that from a legal point of view all assets of a circulating capital nature must be efficiently maintained; but that, as regards assets of a fixed capital nature, there is at any rate a a certain amount of toleration.

What are the divisible profits of an undertaking, is a question which is closely allied with what is the capital of a company, the former, for a correct solution being subsidiary to the latter.

Reverting to Section 1 of our classification, it follows from what we have said that all expenditure on the assets side of a balance sheet in which there occurs a loss, or in which there appears a reduction of value due to any cause, is, to the extent of such a loss or depreciation, a kind of prepayment in practice on account of revenue, because all such losses should find their way into the revenue account. For example, machinery is purchased for £9,000 for the purpose of performing certain work with a view to obtaining revenue. At the end of the first year's use there is a loss for wear and tear, and this continues, it may be, until the employment of the machine becomes an expensive earning medium of revenue, or until it has to be renewed. Now, if the residual value is estimated at, say, £500, and the life at 10 years, it means that revenue must be charged with £850 each year, representing the average yearly amount of its increasing inefficiency or loss of life; and if depreciation be provided in some such manner as presented, the whole of the asset, when dead and renewed, has been paid for out of the earning capacity of the undertaking, because revenue has discharged its obligation to capital by repaying it the amount which it paid for the machine which is now *non est*, and the machine which takes its place may, with propriety, be charged to capital.

We may, therefore, regard the £9,000 (minus £500) as being only temporarily capitalised, because of its perpetual wasting and declining character, in spite of the assistance rendered to it by

efficient repairs and maintenance, which, as it occurs, should be extinguished over subsequent revenue accounts, according to the duration of its serviceable use or its accepted and recognised life as an efficient factor in the work assigned to it for producing revenue, which is the object of all commercialism.

No one reading the balance-sheet would be led to suppose that £9,000 was anything else than the mere book value of the machine after, say, five years, and it is not even worth £9,000 *per se* to the undertaking as a going concern. All assets of the nature to which we are referring must be reduced by the depreciation reserve, if any, and even in that event will be found generally to be totally inadequate.

Depreciation, renewal, or reserve for depreciation, whatever we may term it, should, to the extent that it has occurred, be shown strictly as a deduction from the assets concerned; but it is customary to raise a special account therefor, debiting profit and loss, some showing it erroneously as an appropriation of profit.

There are various methods in vogue of arriving at the amount of depreciation, many of a mixed nature, some based upon the life of the assets concerned, whilst in the electric tramway industry we sometimes find the provision expressed in terms of a rate per car-mile run; but, speaking generally, the amount appropriated to that purpose is of a haphazard character, depending upon what the credit balance of the profit and loss account is, after providing for the usual charges, including debenture interest, if any, and the share capital requirements. The result is that in many cases, owing to the comparatively narrow margin, the profit and loss account is so enfeebled as to be incapable of rendering but scant respect to loss occasioned by wear and tear.

In noticing the following methods it would seem, as a general statement, that for depreciation requirements a decreasing annual sum is preferable to an equal annual instalment having regard to the increasing charges emanating from repairs and maintenance.

Diminishing or Written Down Balance System.—

Machinery standing at	£800
Estimated residual value, realisable value, or value in use at end of estimated term	100
	£700, amount to be written off in 10 years.

Let A = present value, B = residual value, and n = time, it may be easily shown that—

$$100\left\{1-\left(\frac{100}{A}\right)^{\frac{1}{n}}\right\} = \text{the rate at which the asset should be written down from £800 to £100.}$$

We have, therefore—

$$100\left\{1-\left(\frac{100}{800}\right)^{\frac{1}{10}}\right\} =$$

$$100\left\{1-\left(\cdot125\right)^{\frac{1}{10}}\right\} =$$

Log. of $\cdot125 = \bar{1}\cdot0969100 \div 10$

$= \bar{1}\cdot0969100$

$\bar{9}$

$\bar{10}\cdot0969100$

$\bar{9}$

$\bar{19}\cdot0969100 \div 10 = \bar{1}\cdot9096910,$

which is the log. of ·812252. Now, 1 − ·812252 = ·187747 upon 1, or, say, 18·77 upon 100, the rate per cent.:

Value to be depreciated	...	£800
1st year. Charge to profit and loss ...		150·160
		£649·840
2nd year. „ „ ...		121·974
		£527·866
3rd year. „ „ ...		99·081
		£428·785
4th year. „ „ ...		80·483
		£348·302
5th year. „ „ ...		65·377
		£282·925
6th year. „ „ ...		53·111
		£229·814
7th year. „ „ ...		43·140
		£186·674
8th year. „ „ ...		35·040
		£151·634
9th year. „ „ ...		28·470
		£123·164
10th year. „ „ ...		23·120
Written down value		£100·044

which is near enough for all practical purposes.

When debentures or debenture stocks secured by a trust deed on lands, buildings, machinery and other assets are to be redeemed under certain conditions within a stated period, and a sinking fund is created, the amounts credited thereto and debited to profit and loss or profit and loss appropriation, as the case may be, form in themselves a contribution to the depreciation or loss arising on the assets to which the expenditure relates. If they are regarded as contributions towards depreciation, then they are strictly charges against profit and loss, and not an appropriation of it.

The following table shows the redemption in five years of £50,000 debentures, assuming a 5 per cent. rate both for the debenture interest and the sinking fund, to curtail the use of figures—sinking funds are, of course, usually calculated at from 2 per cent. to 3 per cent.

Years. (1)	Debentures to be redeemed. (2)	Annual interest payable. (3)	Annual amount required for redemption. (4)	Amount outstanding. (5)
1	50,000	2,500	9,048·7399	40,951·2600
2	40,951·2600	2,047·5630	9,501·1769	31,450·0830
3	31,450·0830	1,572·5041	9,976·2358	21,473·8471
4	21,473·8471	1,073·6923	10,475·0475	10,998·7995
5	10,998·7995	549·9399	10,998·8000	

If so provided, the amounts standing in column 4 would be debited to profit and loss and credited to the sinking fund.

Annuity method.—

£10,000 in 10 years at 3 per cent.

$$\frac{1}{8\cdot53020} = \cdot117230 \times 10{,}000 = 1{,}172\cdot30, \text{ annual instalment.}$$

* The present value of £1 per annum for 10 years at 3 per cent.

The question resolves itself into one of calculating what annual instalment will repay, with interest at 3 per cent., £10,000.

Years. (1)	Annual instalment to be charged to Profit and Loss. (2)	Principal outstanding at beginning of each year. (3)	Interest on amounts in col. 3 at 3% to be credited to Profit and Loss acct. (4)	Total of columns 3 and 4. (5)	Net amount charged to Profit and Loss acct. (col. 2 − col. 4). (6)	Balance of principal at end of year (5 − 6). (7)
1	1,172·30	10,000	300	10,300	872·30	9,127·70
2	1,172·30	9,127·70	273·8310	9,401·5310	898·4690	8,229·2310
3	1,172·30	8,229·2310	246·8769	8,476·1079	925·4231	7,303·8079
4	1,172·30	7,303·8079	219·1142	7,522·9221	953·1858	6,350·6221
5	1,172·30	6,350·6221	190·5186	6,541·1407	981·7814	5,368·8407
6	1,172·30	5,368·8407	161·0652	5,529·9059	1,010·2348	4,357·6059
7	1,172·30	4,357·6059	130·7281	4,488·3340	1,040·5719	3,316·0340
8	1,172·30	3,316·0340	99·4810	3,415·5150	1,072·8190	2,243·2150
9	1,172·30	2,243·2150	67·2964	2,310·5114	1,105·0036	1,138·2114
10	1,172·30	1,138·2114	34·1463	1,172·3577	1,138·1537	†
	11.723					

† The balance here should be nil. There is, however, a balance of ·0577, owing to the annual instalment not being carried to further decimal places.
The actual instalment is 1,172·3054.
Now, 1,172·3054 × 10 = 11,723·0540
and 1,172·30 × 10 = 11,723
·0540
and ·0577 − ·0540 = ·0037, which would be the difference with the new instalment, and which may be neglected.
The instalment in the table is sufficiently near for our purpose.

Sinking Fund.—

£10,000 of lost or exhausted outlay in 10 years at 3 per cent.

This resolves itself into calculating what annual sum or sinking fund is required to be invested at 3 per cent. to amount to £10,000 at the end of an estimated 10 years' life.

P = the principal.

A_n = the amount of £1 per annum for 10 years at 3 per cent. = 11·46388.

Therefore, 10,000/11·46388 = 872·30501, sinking fund instalment.

Operation of Fund.

Years. (1)	Amount of fund at beginning of year. (2)	Interest thereon at end of year. (3)	Instalment payable at end of year. (4)	Amount of fund at end of year. (5)	Total of cols. 3 and 4, which equals the amount of capital loss to be borne annually by the undertaking. (6)
1	—	—	872·30501	872·30501	872·30501
2	872·30501	26·16915	872·30501	1,770·77917	898·47416
3	1,770·77917	53·12337	872·30501	2,696·20755	925·42838
4	2,696·20755	80·88622	872·30501	3,649·39878	953·19123
5	3,649·39878	109·48196	872·30501	4,631·18575	981·78697
6	4,631·18575	138·93557	872·30501	5,642·42633	1,011·24058
7	5,642·42633	169·27278	872·30501	6,684·00412	1,041·57779
8	6,684·00412	200·52012	872·30501	7,756·82925	1,072·82513
9	7,756·82925	232·70487	872·30501	8,861·83913	1,105·00988
10	8,861·83913	265·85517	872·30501	10,000	1,138·16018

‡ On the supposition that the "want" of the use of the instalments does not cost the undertaking more.

In some instances it may be advantageous to take out a sinking fund or capital redemption policy. For example, supposing the

accumulation of £100 in 10 complete years may be accomplished by an annual payment of £8 9s. 5d., or by a single payment or premium of £74 8s. 3d., which a little calculation will show is at the rate of 3 per cent. The amount of £1 per annum for 11 years at 3 per cent. = 12·80780 − 1 = 11·80780, and—

$$1/11{\cdot}87080 \times 100 = £8\ 9s.\ 5d.$$

The single premium is $1/(1{\cdot}03)^{10} \times 100 = £74\ 8s.\ 3d.$

We may show in a statement the working of the transaction for the period, making the payment at the beginning of each year, and adding thereto, with the subsequent accumulation, interest at the end of the year at 3 per cent., and it will be found that in 10 complete years the amount will be £100. In the event of a single premium, of course, the interest only is added.

There are certain equitable conditions attaching to such policies, which we need not pursue here, and the policies possess surrender values if it be found inconvenient or impossible to continue them.

With regard to the incidence of income-tax, it has been suggested that all depreciation of inherently wasting assets which form a component part of the expense of earning revenue should be allowed as a deduction from taxable profits. Some concessions in that direction have been made by the authorities.

Assets and capital expenditure from the point of view of income-tax may be divided into—

1. Capital invested in the purchase of temporary sources of profit, such as buildings, plant, machinery and ships, furniture and fixtures; natural raw materials, including coal, minerals, stone, gravel, earths, oil, nitrate, and, when intended for sale, land; shaft-sinking, and development undertaken to obtain access to all such raw materials; purchased terminable annuities, and capital invested in terminable foreign concessions which, if they had remained in the hands of the seller, would not have been subject to British income-tax.

The source of profit in all these instances may be looked upon as temporary, from the point of view that such origins of profit cannot be maintained or cannot live without the process of inherent wear and tear, or, as it may be expressed in other terms, that such assets afford production only with the concomitant of waste, and that they cease to yield revenue when they become exhausted.

2. Capital invested in the purchase of a temporary interest in a permanent source of profit—*i.e.*, capital invested in forms of assets other than those we have described in 1, such as goodwill, leaseholds, copyrights, patent rights, terminable concessions within the United Kingdom. No allowance, as at present, should be made, inasmuch (*inter alia*) as they are not represented by a corpus or fund, being of the nature of purchased rights to future income.

Depreciation is not allowed by the income-tax authorities as a deduction from revenue for the purpose of arriving at the taxable profits of the year; but certain measures of relief and allowances at specific percentage rates, or expressed in terms of an agreed unit, on written-down values, have been afforded, the amount allowed being deducted from the average profits for three years for assessment.

Among other things, the authorities have made the following considerations in regard to the permanent-way of electric tramway companies:—

The life of the permanent-way is to be taken as 12, 14 or 16 years, according to the traffic thereon. The classification is to be based on the average car-mileage per mile of track per annum, viz.:

1. Not exceeding 50,000 car-miles per mile of track, 16 years.
2. Over 50,000 and not exceeding 75,000 miles, 14 years.
3. Over 75,000 and not exceeding 125,000 miles, 12 years.
4. Over 125,000 car-miles per mile of track, special consideration.

Where there are special circumstances, such as exceptional gradients and the compulsory use of wood paving, tending to show that the car-mileage does not fairly represent the wear and tear of the track, each such case is entitled to special consideration.

The cost of renewals, including setts or other paving, but excluding concrete foundations, is to be taken at £4,400 per mile of single track until the general renewal of the track takes place.

No allowance is to be made in computing the assessable profits in respect of any expenditure on repairs or maintenance of the permanent-way, but the allowance for depreciation is to be computed at such a sum per annum as will in the aggregate over the determined life of the permanent-way be equal to the cost of renewal as above fixed, plus the estimated repairs for that period.

Cost of renewal per mile as above	£4,400
Add for example—Estimated cost of repairs at £100 per mile per annum for an undertaking with a life of 16 years	1,600
	£6,000
Amount to be allowed per annum in lieu of depreciation, one-sixteenth	£375

The amount to be added in respect of ordinary repairs is to be determined by taking the actual average expenditure as shown in the accounts of the undertaking for the last three years or less period that the company may have been operating.

Repairs under this head are understood to include renewals of special track work at junctions and cross-overs, which occur at frequent intervals.

Lastly, we have the incidence of the purchasing powers of local authorities of tramway and electric lighting undertakings, the various agreements that have been entered into between Councils and companies, in many of which grave questions arising out of the subject of depreciation are involved. These questions are a theme in themselves, and cannot be adequately noticed on the present occasion.

BUSINESS NOTES.

Our Next Issue.—Next Friday being Good Friday, the Electrical Review for that date will be published two days earlier, appearing on the morning of Wednesday, April 3rd. This being so, we shall be glad if contributors and advertisers will take special note of the necessity for sending in matter, &c., for that issue immediately.

Correspondence for publication should reach us by first post on Monday at latest. News matter should be received in the course of that day.

Our Advertisement Department announce that new advertisement copy and alterations to existing displayed advertisements should be in their hands not later than to-morrow (Saturday) morning; but Official Notices and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday next, April 2nd.

Private Meeting.—Grossmith & Co. (William Hugh Smith trading as), 3, Marmion Road, Southsea, and Daniel Street, Portsea, electrical, gas, and water engineers.—A meeting was held in this case on March 18th at the offices of Messrs. Howard, Morris, and Crocker, accountants, Pearl Buildings, Portsmouth, when a statement of affairs presented showed liabilities unsecured £4,254 and gross assets of £1,831. From this latter figure had to be deducted preferential claims of £248, leaving net assets of £1,582, and disclosing a deficiency of £2,671. The liabilities were made up of unsecured trade creditors, £2,314; unsecured cash creditors, £1,327; partly secured cash creditors, £757; less value of security (a second charge on reversion), £144—£613. Fully secured cash creditors consisted of G. T. Aylen £315, value of security £371, surplus to contra £56; Jones £1,021, value of security £1,165; surplus to partly-secured creditors, £144; W. Stanner £1,127, value of security £1,300, surplus to second mortgagee £172. The assets consisted of cash in hand, £28; stock, estimated, £600; plant and machinery, £207; office furniture and shop fittings, £60; household furniture, £95; book debts estimated to produce £540; value of work done on uncompleted jobs, £243; surplus from fully-secured creditors, £56. The chair was taken by Mr. A. W. Bartlett (Evered & Co., Ltd.), and there were present or represented at the meeting trade creditors for over £1,800. It was resolved that the deed of assignment executed to Mr. H. B. Morris, be confirmed, and that a Committee of Inspection, consisting of Messrs. A. W. Bartlett, W. J. Potter (W. T. Henley's Telegraph Works Co., Ltd.), A. R. Holbrook (Holbrook & Son, Ltd.), H. V. Morris (F. & C. Osler, Ltd.), and G. W. Scholey (Corfield & Cripwell), be appointed to assist the Trustee in realisation. The following are the creditors:—

Adnil Electric Co.	£24	Henley's Teleg. Works Co.	£190
Bergtheil & Young	64	Osler, F. & C.	117
Bland Light Syndicate	52	Pritchetts & Gold	49
Bonnella & Son	22	Round, J. & Sons	36
B.T.-H. Co., Ltd.	51	Sanders, W., & Co.	101
Cryselco, Ltd.	85	Siemens Bros. & Co.	33
Edison & Swan U. E. L. Co.	77	Simplex Conduits	79
Evered & Co.	245	Smith, E., Ltd.	60
Falk, Stadelmann & Co.	42	Stearn Electric Lamp Co. ..	154
Frankenberg & Sons	49	Veritys, Ltd.	40
General Electric Co.	85		

The Union Co. at Johannesburg.—Our Durban correspondent writes as follows:—"Messrs. H. Barder & Co., of Johannesburg, selling agents to the Union Electric Co., Ltd., have recently carried out a very complete electrical installation for lighting, heating and power at the new premises of the *Rand Daily Mail*, Johannesburg, current being taken by duplicate feeders from the municipal supply. The lighting installation consists of approximately 500 incandescent lamps and 10 arc lamps; the heating installation provides for 100 KW. throughout the different offices, consisting of Union Electric Co. convectors of from 5 KW. to 2 KW. each. The power installation totals 120 H.P., the principal motors being of 45 H.P. each, used for the large printing machines. These motors are of the interpole D.C. type, 460-500 volts, and are designed for a speed regulation from 100 to 1,200 R.P.M. Speeds from 100 to 600 are obtained by means of series resistance in the armature circuit and the higher speeds by resistance in the shunt. The output of the two printing machines is 50,000 newspapers per hour between them. The controllers are of the tramway pattern, and they are fitted with no-voltage release. Other motors of 5 H.P. are used for the linos. and other auxiliary machinery. Altogether some 10 miles of wire have been used in the wiring of the building. Among other contracts recently carried out by the Union Electric Co., of which Mr. H. W. Curling is the Johannesburg manager, is a motor-driven centrifugal pump for the Rand Water Board. The motor was of the Union Co.'s make, giving 130 H.P. on 2,000 volts 50 cycle three-phase, and included a liquid starter and H.T. control panel. The pump was by the Pulsometer Co., England. The Union Co. have also in hand the contract for the arc lighting of Messrs. Chudleigh Bros., drapery establishment in Johannesburg, consisting of 96 lamps, 48 being of the Excello pattern, rated for 10 amperes, and burning four in series on 230 volts. The remaining 48 are of the open type, rated for 8 amperes, also burning four in series. All the lamps are fitted with the Union Co.'s 'Kandem' coupler for purposes of lowering the lamps, by which ropes, winches and pulleys are eliminated. An order has just been placed with this company for 100-S.P. double quick-break switches of special design for the Johannesburg Municipality feeder boxes. Further installations by this company are of large three-phase motors for the Johannesburg Brick and Pottery Co., and three-phase motors for the City and Suburban Gold Mines, also single-phase motors for the Johannesburg Municipal Sewage Pumping Station."

Trade Announcements. — The Langdon-Davies Motor Co., Ltd., are now in occupation of their new premises, Eastdown Works, Dermody Road, Lewisham, S.E., where all goods should be forwarded.

Mr. Donald Smeaton Munro, A.M.I.E.E., having acquired the Edinburgh business of Messrs. Anderson & Munro, will now trade under his own name as electrical engineer and contractor, at 11, Randolph Place, Edinburgh.

The Viscose Development Co., Ltd., have transferred their City office to their works, and all communications should in future be addressed to them at Semreh Works, Pembroke Road, Bromley, Kent.

The Midget Electric Lamp Manufacturing Co., Ltd., Bothwell Street, Fulham Palace Road, Hammersmith, W., have, by a special resolution and with the approval of the Board of Trade, changed their name to the Midget Lamp Co., Ltd.

Mr. John Noble, electrician of 10, North Street, Peterborough, has disposed of his business to Mr. Arthur Bull.

Catalogues and Lists. — Messrs. Siemens Bros. Dynamo Works, Ltd., 38 and 39, Upper Thames Street, E.C.—A folding price-list of "Glossup" electric irons for domestic and laundry service has been issued by the firm. These irons are finished in polished nickel plate on copper. A number of copies of the list can be had with distributors' name and address printed thereon.

Messrs. T. Francis & Sons, 41, Hampden Street, Bolton.—Twenty-page illustrated catalogue of electrical theatrical accessories, &c. Prices and brief notes are given of the Francis hand-feed arc, standard pattern and box pattern resistances, square and circular type stage boxes, proscenium lamps, "Rheo" resistance wire, cable and flex, lacquers, and many details.

Messrs. Union Electric Co., Ltd., Park Street, Southwark, S.E.—Eight-page pamphlet (No. 112) containing brief descriptive matter, and a number of neat illustrations, relating to electric driving of grinding machinery.

The Adnil Electric Co., Ltd., London, E.C.—Illustrated and priced leaflet (No. 69E) relating to their automatic switch for lighting staircases, &c.

Messrs. Chas. Joyner & Co., Ltd., Icknield Square, Birmingham.—Illustrated priced leaflets showing electric table standards with winding gear; the "Trolley Light" comprising a ceiling plate and swinging arm, and a pulley or trolley running thereon, for drawing offices, workshops, hospitals, &c.; and spring-drum ceiling roses.

Mr. E. C. Berridge, 46, Queen Victoria Street, London, E.C.—Circulars describing the Liberty Heavy Duty turbine cleaner, and Merrill's patent "twin" strainers for purifying water supply.

The Jandus Arc Lamp and Electric Co., Ltd., of Hartham Road, Holloway, London, have sent us a charming lithographed drawing of a lady's bust, in similar style to that of the one received last year. Incidentally, in the right hand bottom corner of the large mount, there is a calendar for 1912.

Messrs. Electric Control, Ltd., 177, Reid Street, Bridgeton, Glasgow.—Booklet of between 30 and 40 pages containing illustrated descriptions of the more important applications of their patent automatic control gear for direct and alternating current. The following will indicate the contents:—"Empire" automatic controllers for D.C. (single solenoid and multiple unit types), for A.C. (small and large size), remote control for D.C. and A.C., automatic control of pumps for D.C. and A.C., hydraulic accumulators, air compressors, capstans, plate-edge planing machines, "Empire" printing press control, and lift control.

Dissolutions and Liquidations.—Imeson, Finch and Co., Ltd., Bridge Road, Stockton-on-Tees.—In announcing a first and final dividend of 1s. in the £ for the unsecured creditors, Mr. T. R. G. Rowland, the liquidator, has issued a statement of realisation and disbursements as at March 14th, 1912, as follows: Realisations—Purchase price of assets sold, £1,945; balance of receiver's receipts above expenses, £31 — £1,976. The disbursements were: Preferential creditors, rent, rates and wages, £86; first mortgage debentures and interest, £1,687; administration expenses, £115; dividend at 1s. in the £, £87.

De Forest Wireless Telegraph Syndicate, Ltd.—A meeting is to be held on April 24th at 147, Leadenhall Street, E.C., to hear an account of the winding up from the liquidator (Mr. S. J. Ashby).

Beaumont and Still Colonial and Foreign Train Lighting Co., Ltd.—A meeting will be held at 29, Charles Street, Hatton Garden, E.C., on April 29th, to hear an account of the winding up from the liquidator (Mr. C. T. Burke). A similar meeting of the Beaumont and Still Train Lighting Co., Ltd., will be held on the same day.

Lamp Contracts.—A contract from Messrs. Balfour, Beatty & Co. for the supply of tantalum traction lamps for 12 months, and one for the supply of tantalum traction lamps for ship lighting for the White Star Line Co., have been placed with Messrs. Siemens Bros. Dynamo Works Co., Ltd.

Wotan Lamps.—Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, are about to introduce 10 and 16-c.p. high-voltage lamps. They believe the 10-c.p. lamp to be the first metal lamp of this c.p. to be made in this or any other country with a filament of pure drawn tungsten wire. The makers expect to obtain an average life of 1,000 hours with this lamp. According to present expectations the maximum power consumption will be 11 watts. The bulb will be extremely small, and it is considered that there will now be no case in which the use of carbon lamps will be economical. The firm will shortly be ready to accept orders for the new 10 and 16-c.p. lamps, and they are now accumulating stocks. We are informed that they have further "Wotan" lamp developments in hand, and that they intend to maintain their priority. The firm also announce that they have now decided to supply "Wotan" lamps for series burning without the extra charge of 5 per cent. which has hitherto been made. Many consumers are still using low-voltage metal lamps in series, having wired their premises accordingly, and there is on this account a very large demand for series burning "Wotan" lamps.

Book Notices.—"Official Gazette of the United States Patent Office." Vol. 176. No. 2. March 12th, 1912. Washington: Government Printing Office.

"*Journal* of the Franklin Institute." Vol. CLXXIII, No. 3. March, 1912. Philadelphia, Pa.: The Institute.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVIII, Part 4. March, 1912. Newcastle-on-Tyne: The Institution.

"The Electrical Properties of Flames and of Incandescent Solids." By Harold A. Wilson. 1912. London: Hodder and Stoughton. Price 6s. net.

"Elementary Internal Combustion Engines." By J. W. Kershaw 1912. London: Longmans, Green, & Co. Price 2s. 6d. net.

"Yellow Sands." By A. Gowans Whyte. 1912. Edinburgh: Wm. Blackwood & Sons. Price 6s.

"Irrwege der Naturlehre." By Johannes Zacharias. 1912. Hamburg: Hephaestos-Verlag. Price 1 M

"International Electrotechnical Commission. Report of Turin Meeting, 1911." London: From the General Secretary. Price 1s. 2d.

Mexico.—A company has just been formed in Berlin with a capital of £100,000, and the title Die A.E.G. Mexicanische Electricitäts Gesellschaft, to represent the A.E.G. interests in Mexico and Central America.

Easter Holidays.—The Walsall Electrical Co., Ltd., announce that their works will be closed from Thursday evening next, April 4th, until Wednesday morning, April 10th. A small staff will attend to urgent correspondence, &c.

For Sale.—The Sheffield Corporation has for disposal a quantity of steam-raising plant, comprising boilers, oil separators, superheaters, &c., at Kelham Island tramways power station. See our advertisement pages to-day.

LIGHTING and POWER NOTES.

Argentina.—The Buenos Ayres Municipality has created a special office to fiscalise the carrying out of the contract of the Compania Alemana Transatlantica de Electricidad. Engineer B. Laurel has been placed in charge of same.—*Review of the River Plate.*

Baldock.—Messrs. J. B. Saunders & Co., Ltd., have approached the U.D.C. with reference to an electric lighting scheme, offering, under certain conditions, to find the necessary capital to carry out the work. The Council has decided to take no action in the matter.

Birmingham. — The Corporation Electricity Supply Committee proposes to borrow £10,000 for "wiring" in connection with installations for electric lighting, to be paid for by tenants on the hiring system. The chairman of the Committee stated that it is proposed that the tenant shall pay the cost of the "wiring" by a payment of 10 per cent. down, the other payments to be spread over a period of two or three years. The work of installation is to be done by private firms.

Bootle.—According to the financial statement submitted to the T.C. on March 22nd, the electricity supply account showed that the approximate net surplus for the current year would be considerably below the estimate, and compared very unfavourably with the results in recent years. There had been a slight decline in the income from sales, and the cost of production had been exceptionally heavy, due, principally, to increased coal consumption, higher rating assessment, law costs, and fees to rating and electrical experts. The gross profit would amount to approximately £8,438, or 7·3 per cent. of the average capital expenditure, compared with £10,157, or 8·83 per cent. in the previous year. The net surplus would amount to £1,720, or £1,030 less than the estimate. It was assumed that no additional revenue would accrue during the ensuing year, as a result of the new extension scheme, and the capital charges would be increased in consequence thereof.

Burnham (Somerset).—The U.D.C. has sealed the agreement with Dr. Purves for the electric lighting scheme for the district. The maximum price of current for lighting has been altered from 8d. to 6d. per unit, and Berrow has been struck out of the scheme.

Chatham.—Experimental lighting by electricity is being carried out in High Street by the T.C. in conjunction with the Kent Electric Power Co., which has erected four lamps.

Continental Notes.—Denmark.—According to the statistics of Danish electricity undertakings in 1910, all Danish towns of 5,000 inhabitants and above are furnished with electric installations. Of towns having between 5,000 and 3,000 inhabitants only

three are without electric services. Copenhagen possesses the largest equipments, having three generating stations of an aggregate capacity of 26,340 H.P., and an output during 1910 for light, power, and tramways of 8,621,000, 8,549,000, and 8,815,000 KW.-hours respectively. The total cable length was 521·99 km. At the moment, Denmark possesses only one installation, which may be regarded as an "überlandcentral"—namely, that at Skovshoved, near Copenhagen. This generates 10,000-volt three-phase current, and supplies by means of a distributing network of 131·5 km. extent, almost the entire suburbs of the capital, with light and power. At the same time, this station supplies direct current to the tramways to Hellerup and Klampenborg. The aggregate station output totalled for the year 2,290,000 KW.-hours. Several of the towns equipped with direct-current installations supply the neighbouring rural districts with H.P. three-phase current. The greatest pressure thus employed is 10,000 volts. Some of the stations lately built are wholly three-phase without batteries. Apart from the largest installations in the cities, the power plants erected are driven by Diesel motors, built mostly by Burmeister & Wain, of Copenhagen. The Diesel motor of this form has also found its way in recent years into the large municipal stations, where it works in parallel with the existing steam plants.—*Elektrotechnische Zeitschrift.*

Portugal.—The *Diario* of March 9th publishes a notice approving a contract between the municipal authorities of Penafiel and Sr. Luis Nunes Borges Madureira de Carvalho, whereby the latter is authorised to set up a central electric generating station for the purpose of supplying electric light to the town of Penafiel.

France.—The plans are under consideration for the establishment of a distribution network, having its source at Vire and intended to serve at first the most important Communes, and eventually the greater number of the villages in the arrondissement. The aim of the scheme is principally to supply motive power for agricultural users, and for the minor industries. Construction works will shortly be begun.

Plans have been drafted by MM. Harlé, Blondel and Mähl for the utilisation of the water-powers of the Upper Rhone. It is intended to construct a dam 70 m. high near Génissiat. The Rhone waters will be dammed up from here to near the Swiss frontier, and, a fall of between 67 and 69 m. obtained, a 60-m. wide canal leading to the power house, which will be equipped with 24 turbo-dynamos of 10,000-KW. capacity each. The site of the dam is geologically favourable, as rock is met with at 40 m. below the surface of the water. Interference with navigation will be obviated, either by the construction of a number of locks or of a single ship lift near the dam. According to the observations made, the available water-power the year throughout never sinks below 78,000 H.P.—*Zeitschrift fur Turbinenwesen.*

Cuba.—Sr. Francisco Diego Madrazo, President of the Manzanillo Water and Light Co., is to establish, with the consent of the municipal authorities of Manzanillo, a central electric generating station, for the purpose of supplying electric light to that town.—*Board of Trade Journal.*

Dendraeth.—The Rural Council has announced that a syndicate has been formed to establish electric lighting schemes at Harlech and Llanbedr; these places are now lighted by oil lamps.

Dundee.—The Corporation has completed negotiations for a supply of current to some large motor installations. At a foundry in the Blackness district over 700-H.P. of motors are being installed, ranging from 10 H.P. for small blowers, to 200 H.P. for main drives. A 200-H.P. motor and some smaller ones are now working. A calender works in the centre of the city, after a successful trial with motors, have decided to abandon their steam plant in favour of a complete electric drive, which will amount to over 240 H.P.

Finchley.—At the last meeting of the U.D.C., it was reported that the assessment of the electricity undertaking had been reduced to £3,345 gross and £1,400 rateable.

Farnborough.—The U.D.C. has passed plans for an electric generating station in Farnborough Road for the Aldershot Gas, Water and District Lighting Co.

Farnworth.—A L.G.B. inquiry was held on the 19th inst. into the D.C.'s application for sanction to borrow £3,000 for purposes of the electricity undertaking, and for additional loans for public offices and in respect of the refuse destructor. In regard to the electricity works, the clerk stated that they were established under a provisional order in 1897 and commenced actual working in 1901. Since then the loss on the works had been £1,667, an average of £185 yearly, but they were confidently hoping for better things in the near future, and they had at present 301 consumers, which was a record. Since the inception of the works they had paid £20,474 for principal and interest, and of that £10,564 represented loan capital repaid. There was no opposition.

Golborne.—The B. of T. has revoked the 1905 E.L. order.

Great Missenden.—The P.C. has decided to hold a parish meeting to discuss and consider an electric lighting scheme initiated by Mr. G. White, on behalf of a company which is prepared to supply current at a most reasonable rate.

Greenock.—Negotiations are still proceeding between the Corporation and Port Glasgow T.C. in connection with the scheme under which Greenock is to supply shipbuilders and others in Port Glasgow with electricity. The proceedings have been conducted in private, but it is believed that Greenock desires Port Glasgow T.C. to give a guarantee that neither the Corporation nor any other company will be allowed to supply electricity to Port Glasgow for 30 years, the time required to pay off the capital expenditure of £25,000 by Greenock.

London.—Hackney.—The Electricity Committee of the B.C. reports that it has received a request from the Stoke Newington B.C. asking Hackney to assist it, owing to the possibility of the North Metropolitan Electric Supply Co. being unable to supply it if the coal strike continues. After carefully considering the matter, the Committee decided that affording a supply would make very little difference to the period during which it would be able to continue giving a supply from the large stock of coal which it has in hand, and it has instructed the borough electrical engineer to make an offer on the following terms, subject to the approval of the B. of T.:—(1) The supply to be taken from the network at Amhurst Road and Cazenove Road to such an extent as may be possible without unduly lowering the pressure of supply; (2) The charge for the supply to be at the same rate as the Stoke Newington Council pay the North Metropolitan Co., viz., £1 per quarter per KW. demanded, plus, per unit—First 5,000 units per annum, ·96d. per unit; 5,000 to 25,000, ·65d.; 25,000 to 50,000, ·55d.; 50,000 to 75,000, ·45d.; above 75,000, ·35d.; (3) The whole of these terms to be subject to the addition of 12 per cent., as in the case of this supply the cost of transformation and conversion will not be incurred.

Merthyr Tydfil.—The Electric Traction and Lighting Co., Ltd., has applied to the B. of T. for consent to erect overhead lines for the transmission of energy at a pressure of 460 volts from the Taff Vale goods yard to Brandy Bridge Junction for the purposes of supply, under the E.L. order, 1899.

Oldham.—The Chamber of Commerce has sent a letter to the Electricity Committee of the T.C. calling attention to the fact that the department continues to supply motors and undertake repairs to them, despite the assurance given some time ago that it would not do so. The letter also directed attention to injunctions which had been granted in other towns against this trading in motors. When the matter came before the Committee, Mr. Newington said no such assurance, as stated, had been given. The Committee said it would not push these things, but if people came to it in preference to other contractors, it would supply them; everyone who came were asked if they had been to contractors. No profit was made on the business; the profit was in the energy supplied. It was decided to ascertain what the Committee actually promised.

Peterborough.—The T.C. has instructed its engineer (Mr. J. C. Gill) to purchase 24 automatic time switches to control the public lamps.

The G.N. Railway Co. has applied for a supply of electricity for power purposes at its works in Priestgate. The request has been complied with, an extension of the Corporation mains being involved.

Rawtenstall.—The T.C. is having a scheme prepared for lighting by electricity the main roads in the borough so far as they are co-extensive with the tramway routes.

South Africa.—According to the East Rand Proprietary Mines report, the erection of the last 6,000-KW. turbine set in their power house was completed in March last, and it has run satisfactorily during the year. The monthly output of the station at present exceeds 4,700,000 units, as compared with 3,500,000 units at the end of 1910. This increase in power has been chiefly utilised to run the Comet and Driefontein Mills, the former electrically driven since May, and the latter since October.

Permission has been granted to the Transvaal Gold Mining Estates, Ltd., and to Glynn's Lydenburg, Ltd., to supply electric power to consumers in the mining district of Pilgrim's Rest.

Southend-on-Sea.—The T.C. has sanctioned mains extensions at a cost of £755. If the Education Committee pays half the cost (£64) of extending the mains, current will be supplied to the Westborough schools, which are already wired.

Sunderland.—The *Daily Mail* states that the Corporation, which supplies electric current to the whole of the shipbuilding yards and engineering works on Wearside, has given notice that the supply will cease next week, owing to the lack of fuel.

Watford.—Mr. Goodrich, in moving the adoption of the various recommendations of the Electricity Committee, at the last meeting of the Council, said that it would not be necessary to install new plant except in time for the winter of 1913. The cost per KW. of plant installed was £53, but under the new extension, the figure would be reduced to £47. During the past five years the undertaking had contributed £2,201 in relief of the rates, and to this sum is to be added £850, the contribution for the present financial year. With regard to private lighting, they were making an all-round reduction of ¼d. per unit.

Whitefield.—Messrs. Nelson & Greenhalgh, who are building a new shed of 400 looms, have engaged Mr. E. M. Lacey, consulting engineer, to design the electrical equipment for an inclusive fee of 250 guineas.

TRAMWAY and RAILWAY NOTES.

Acton.—At the last meeting of the Council, the accountant reported that the London United Electric Tramways Co. had had its assessment reduced, and had sent in a cheque for an amount equal to one-fourth of the rateable value. He had written to the company, stating that the cheque would be accepted if it would give an undertaking to repay the balance of the amount claimed in the event of the decision of the Courts being reversed by the House of Lords, to which the matter is to be taken. This, however, the company refuses to do. The difference between the amount claimed and paid is about £20. The matter was left in the hands of the accountant.

Australia.—The electrification of the Newcastle (N.S.W.) tramway service, which is owned by the Government, has been talked about for some years past, but the proposal seems to have hung fire owing to financial considerations. Recently a conference of representatives of the Newcastle Council and the suburban Councils was held, when it was decided to send a deputation to the Premier to urge upon him the necessity for the immediate electrification of the tramway system.

Many schemes have been put forward and many suggestions made for relieving the pressure of the Sydney traffic both by electric tramways to the various suburbs and by ferry boats to the northern suburbs; but no definite proposal has emanated from the Government. With this object in view, the Government has now decided to obtain the services of the highest British engineering authority on city traffic, and Mr. David Hay is to go to Sydney and make the necessary report.

Barking.—The Tramways Sub-Committee reports having considered the advisability of removing the tramcar sheds from Beckton to the rear of the Town Yard. The cost of this, the surveyor estimates as follows:—Brickwork car-sheds sufficient to house 12 cars, £3,000; stores and workshops, £533; demolition and re-erection of old car-shed on new site as paint and workshops, £250; tramway track and overhead equipment, £1,717. By this removal the engineer estimates that an annual saving of £189 will be effected. In view, however, of the proposed large expenditure on capital account by the electricity department, and in view of the proposed through running arrangements between Loxford Bridge and Aldgate, the Sub-Committee has decided to defer the consideration of the matter for a period of six months.

Belfast.—The motormen and conductors of the Corporation tramway have been put on their notice to terminate the weekly engagement *pro tem.*, and from next week will be on a daily engagement in consequence of the coal strike. At the generating station preparations are being made to put in boiler equipments to use oil fuel. It was reported that there were four weeks' supply of coal on hand for electrical supply.

Blackpool.—The Corporation tramways at North Shore and along Lytham Road are to be re-opened for Easter week. The work of relaying the latter track will be completed, but that from Queen's Square to the Gynn will only be used up to the Thursday in Easter week, and then the work of completion will be proceeded with as quickly as possible.

The most interesting item in reports submitted to the Blackpool Tramways Committee on March 21st was the fact that the receipts from April 1st to March 14th show a net increase of £7,772 over last year, the figures being £63,213 and £55,441. Passengers increased 1,334,314, making the receipts 2d. per car-mile more, whilst the car-mileage has been reduced by 5,461.

Bradford.—The city is exceptionally fortunate in its supplies of coal for electrical as well as for other purposes. The city electrical engineer, Mr. T. Roles, announces that his department can hold out comfortably until Easter without any curtailment. There has not been, and it is anticipated will not be, any curtailment of cars on the tramway service; indeed, it is stated that extra current has been used recently, because the slackening of the railway services has led to a greater demand for tramway facilities. A factor in the situation which is of aid to the Corporation has been the lessened energy consumption owing to the closing of many works, although this is counter-balanced to a great extent by the large increases in the installation of electric radiators in place of fires in private houses. The dull weather, also, has acted adversely. The tramway receipts for the week ending March 16th were £5,602, showing an increase of £716 over those of the corresponding week of last year. Leeds, on the other hand, has found it necessary to withdraw 40 of the 200 cars which daily run in the city.

The Corporation Tramways Committee proposes to make an important change regarding workmen's fares. At present a general penny fare is charged for any distance on the route up to 8 o'clock in the morning. It is proposed to abolish this, and make all ordinary penny stages halfpenny ones up to 9 o'clock. Those travelling one stage will thus be ½d. better off, and those travelling three, a ½d. worse off. The department stands to lose £11,000 by these changes, unless traffic increases. It is also proposed to allow children working to travel at half the ordinary fare, the same as school children.

Bury.—The manager of the local tramways has drawn the attention of the Tramways Committee to an important alteration in the interpretation of the law in relation to the rating of tramways, which will now be assessed at one-quarter only of the annual value instead of at the full annual value. In Bury the department will have to pay £455 less in rates, and the profit to the borough fund may be expected to increase by that amount. In the case of the tramways outside the borough, the department will have to pay £230 less in rates.

Canada.—According to the *Standard* negotiations have been completed for the sale of the Winnepeg Electric Railway and its allied interests to a New York syndicate.

Chile.—The Government has granted a concession to Mr. A. Cousino for an electric railway from Quintero to Nogales, Province of Valparaiso. The capital to be employed amounts to $2,500,000 gold.—*Review of the River Plate.*

Continental Notes.—FRANCE.—A scheme is at present under consideration for the construction of an electric railway to give communication between the Cantons of Quillan and Belcaire, on the one hand, with those of Querigat (Ariege) and Mont Louis (Pyrenées Orientales) on the other.

A new company has lately been formed in Paris, with the title La Société des Tramways Nord de Marseilles, and with a capital of £240,000 to construct and work an electric tramway between Marseilles and Salon.

AUSTRIA.—The municipal authorities of Schonberg, Tyrol, are considering a scheme to put down a plant to utilise certain available water-power to supply the electrical energy necessary for the projected electric tramway between Patsch and Schonberg.

East Kent.—The Light Railway Commissioners last week held an inquiry at Sandwich into the application of the East Kent Light Railways Co. for two extensions to their previously sanctioned lines, intended to serve two projected collieries at Wickhambreaux and Great Mongeham. The only objection raised was with reference to level crossings, and the order applied for was granted.

Huddersfield.—It is proposed to extend the tramways on the railless trolley system to Brighouse, Mareden, Mirfield, Elland, Holmfirth, Dalton, and Golcar. The manager of the tramways has been instructed to report upon the probable cost, working expenses, and revenue.

Ilkeston.—In consequence of the coal strike the electric tramway service has been entirely suspended, owing to the inability of the local electricity department to supply power. It is expected that another week will suffice to stop the factories using electricity.

L. and Y. Railway.—According to the *Times*, Messrs. Dick, Kerr are to electrify this company's Bury-Holcombe Brook line on the H.T. direct-current system, using an overhead conductor at 3,500 volts.

Liverpool.—The annual report of Mr. C. W. Mallins, the Corporation Tramways manager, for 1911, shows that there has been an all-round increase in mileage, receipts, and passengers carried, the increase in the passengers being 2·5 per cent. and the receipts 3·2 per cent. A gross profit was made of £224,343, net £114,731, an increase (net) of £16,465 over 1910. Of the profits, £38,244 is allotted as a contribution in relief of rates, an amount which is £5,488 in excess of the sum devoted to rates in 1910; £50,109 is apportioned to interest; £59,502 to sinking fund and repayment of loans; and £76,488 to reserve, renewal, and depreciation account.

Experiments are to be made with two new types of tramcar, designed by Mr. Mallins, and if they are successful it is proposed to put them on the Liverpool routes. One is a bogie car, with an over-all length of 36 ft. and seating accommodation for 84 passengers, with a double staircase inside the body of the car, at the centre affording separate entrance and exit to the upper deck, which also provides separate entrance and exit for the lower deck. The leading feature of this car lies in its central platform, the two outside portions of which are used as exits, and the larger or centre portion as an entrance. By this means all passengers boarding or leaving the car are brought to a focus under the control of the conductor. The object is to enable the car to load and empty simultaneously, avoiding confusion and loss of time. As the platform has ample standing space, the car can be started without delay, and the conductor can collect fares before the passengers disperse to the different compartments. The other experimental car is a single truck coach, 31 ft. long, carrying 74 passengers. This also has double staircases at each end, and the fares can either be collected when passengers are entering the car or at any time of the journey. On this car there is to be tried a signalling arrangement which, independent of the conductor, will let the passengers know the car is about to start. The Corporation is to have the unrestricted right for all time in manufacturing, acquiring, and using these cars, staircase, platform, barrier, and automatic signalling apparatus, on payment of the patent fees and Mr. Mallins's out-of-pocket expenses.

London.—According to the *Daily Telegraph*, the Central London Railway Co. is at present relaying its track, which has been in use since 1900. About 50 ft. of track is being relaid nightly, with cross sleepers instead of the old longitudinal sleepers, the work also including the taking up of the concrete sleeper bed and provision of a fresh bed.

The Highways Committee of the L.C.C., with the Improvements Committee, has decided to submit further proposals in regard to the construction of tramways over the new St. Paul's Bridge, terminating underground near Cheapside.

Manchester.—A special meeting of the Tramway and Vehicle Workers' Association was held on Sunday, when a new programme of working conditions was formulated. The new demands include a farthing per hour advance for all motormen and guards;

an eight-hours day for Sundays; overtime at the rate of time and a half for all hours over nine each day; and a minimum wage of 26s. per week for all men employed in the traffic department.

Newcastle.—The Tramway Committee last week decided to make a grant of £12,000 to the relief of the rates. It also resolved to try for three months an experiment of ½d. fares on the inward stage near the centre of the city, from Northumberland Street to the railway station.

Perth.—The artistic tastes of certain citizens having been offended by the letting out of the tramway standards for advertisement purposes at £100 a year, the T.C. communicated with the contractors with the view of cancelling the bargain. The reply received was to the effect that while the contractors would be sorry to lose the advertisements, they might manage to get their clients to countermand the shields on payment of £600. The Tramways Committee has agreed to let the matter rest, although it was jocularly observed that the signatories to the petition sent to the Council might be willing to pay £1 per head to get the advertisements removed.

Rawtenstall.—The Secretary of the B. of T. has written to the Corporation on the subject of the recent accident at Accrington to one of the Corporation cars, and the Board notes with satisfaction that it has been decided to convert the Corporation car equipments to the ordinary controller type. The Corporation has decided to advertise for tenders for the extension of the electricity works.

Rothesay.—The tramway accounts for 1911, after providing for renewals and depreciation, show an available sum, including £232 brought forward, of £1,265, from which £200 has been placed to depreciation and reserve, and the full dividend of 5 per cent. paid on the preference shares, leaving £165 to be carried forward.

Usworth (Co. Durham).—At a parish meeting it was decided to communicate with the Gateshead Tramway Co., with a view to obtaining, if possible, a system of railless cars to connect the Usworth district with the Wrekenton and Heworth systems.

West Bromwich.—Mr. H. Jackson, the electrical engineer to the Corporation, has outlined a scheme for the use of railless cars along a 27-mile route, using 30 cars with a 15-minute service. The estimated capital cost is £76,000, against £331,000 for tramways.

TELEGRAPH and TELEPHONE NOTES.

Admiralty Wireless Stations.—Replying to a question in Parliament last week, Mr. Churchill said the wireless messages from the *Delhi* were taken in by His Majesty's ships at Gibraltar, and it was not the fact that the news of the wreck was first received by the naval authorities through the wireless station at Cadiz. The International Wireless Convention provided for the differentiation between commercial and naval wave lengths. Whenever a sufficient number of men-of-war were in company, a look-out was kept by one of them on a commercial wave length. Naval shore stations, however, had to look out on naval wave lengths, and consequently commercial ship or shore stations would not ordinarily be able to communicate with them. This differentiation was necessary, and he did not propose to alter it.

Australia.—The *Australian Mining Standard* of February 22nd states that the Marconi Wireless Telegraph Co. has issued a writ asking for an injunction against the use by the Commonwealth Government of the plaintiff company's system, and damages for alleged infringement of the patent rights of the company for each of the six States of the Commonwealth. Action had previously been taken by the company against the Australian Wireless Co. of Melbourne.

Marconi Patents Upheld in U.S.A.—The Marconi Wireless Telegraph Co., of America, have succeeded in their action in New York, against the United Wireless Telegraph Co. and Clyde Steamship Co. In this action, which was brought for infringement of the Marconi Co.'s American patent, corresponding to their well-known English Patent No. 7,777 of 1900 (the master patent covering the principle of syntonisation and selectivity), and which was already part heard, both the defendants acknowledged the validity and scope of the patent, admitted their infringement, and submitted to judgment and a permanent injunction in favour of the Marconi Co. The 500 ship installations and the 70 land stations which have been erected and worked by the United Wireless Telegraph Co. pass into the hands of the Marconi Co. The parent company, Marconi's Wireless Telegraph Co., Ltd., have an action pending in this country against the United Wireless Telegraph Co. for infringement of Letters Patent Nos. 12,326, of 1898, and 7,777, of 1900, by the installation of the United Wireless system on various British boats, and the defendants are about to consent to judgment in this action also. As a result the installations on the ships carrying the British flag and fitted with the United Wireless system will pass into the possession of the Marconi Co. The effect of this decision is to confirm the judgment of Mr. Justice Parker, given last year in the action brought by Marconi's Wireless Telegraph Co., Ltd., against the British Radio-Telegraph and Telephone Co., Ltd., upholding Patent No. 7,777 of 1900, and also to give the same value and importance to the corresponding American Marconi patent.

Japan.—It is reported from Tokio that some successful trials have just been made with a system of wireless telephony invented by Mr. Kitamura, a mechanical engineer connected with the Japanese Department of Communications.

CONTRACTS OPEN and CLOSED.

OPEN.

Ashton-under-Lyne.—The Board of Guardians is to invite tenders for the electric lighting of the workhouse, as the present gas-fittings are worn out.

Australia.—Victoria.—April 23rd. 2,000-kw. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" March 1st.

April 24th.—Power generating plant for the Federal Capital site. Secretary, Department of Home Affairs, Russell Street, Melbourne.

May 1st and 8th.—Cable for P.M.G.'s Department.

May 14th.—Telephones, switches, condensers and protectors, for Melbourne. See "Official Notices" March 22nd.

May 15th.—One electric motor-car, two electric motor-wagons. Mr. John Clayton, Town Clerk, Melbourne.—*Australian Mining Standard.*

May 21st.—P.M.G., Melbourne. 30 miles of cable, 24¼ miles of cable, 699 non-polarised relays.

July 23rd.—P.M.G., Melbourne. Nine sections of a lamp-signalling trunk-line switchboard.

Queensland.—April 24th and May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" March 15th.

May 8th.—Telegraph and telephone instruments, switchboards and accessories, measuring instruments and protectors, for the P.M.G.'s Department. See "Official Notices" March 22nd.

South Australia.—April 24th. Telephone and telegraph material, for the P.M.G.'s Department. See "Official Notices" March 15th.

Western Australia.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" March 22nd.

Belfast.—April 8th. Two 750-kw. turbo-alternators, condensing plant, and E.H.T. switchgear, for the Corporation. See "Official Notices" March 8th.

Birmingham.—April 3rd. Electric motor and centrifugal pump for the Birmingham, Tame, and Lea District Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

Brazil.—Pernambuco.—April 18th. Concession for the establishment and working of several lines of electric tramways. Preliminary deposit, 20,000 milreis; final deposit, 80,000 milreis. Particulars, Direction Générale des Travaux Publics, Pernambuco.

Bulgaria.—Sophia.—April 11th. Supply of 71,100 No. 2 and 10,100 No. 3 phosphor insulators. Particulars, on receipt of stamp-tax of 20 centimes per copy and 50 centimes per drawing, from the Post and Telegraph Administration, Sophia.

Caerphilly.—April 2nd. Complete electric light installation at the Energlyn Isolation Hospital, for the U.D.C. Mr. A. O. Harpur, engineer and surveyor, Council offices (returnable deposit of 10s. 6d.).

Cape Town.—May 15th. Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal.*

Dublin.—April 15th. Flame arc lamps and suspension gear, for the Corporation. See "Official Notices" to-day.

France.—Rouen.—Six 4,000-kg. capacity and four 2,500-kg. capacity electric cranes, with automatic driving machinery, for the harbour. Particulars, Président de la Chambre de Commerce, Rouen.

Hungary.—Nagysomkut.—April 10th. Concession (50 years) for erection of a generating station and supply of lighting. Deposit 400 kronen. Particulars, Grossgemeinde Nagysomkut, Szatmar County, Hungary.

Krakau.—April 15th. For the railway workshops at Neu Sandez. One electric drilling machine for 20-mm. holes, one electric exhauster, one portable electric boring machine for 50-mm. holes, one electric circular saw (for wood), two turning lathes of 200/1,000 mm. and 150/750 mm. respectively, one pneumatic riveting hammer, one 1-H.P. continuous-current motor, and one 2½-H.P. three-phase-current motor, &c. Deposit, 5 per cent. of cost. Particulars, K.K. Staatsbaudirektion, Krakau.

London.—L.C.C.—April 16th. Supply, during twelve months, of 484 tons of rolled-steel bar, special section, for magnetic brakes of electric cars. Chief Officer of Tramways, 62, Finsbury Pavement, E.C.

April 16th.—Electrical installation at the Lyham Road School. See "Official Notices" to-day.

Metropolitan Asylums Board.—April 10th. Two electrically controlled passenger lifts at Tooting Bec Asylum. See "Official Notices" March 22nd.

Metropolitan Water Board.—April 12th. The Board is inviting tenders for 6 Diesel oil engines and two 10-ton overhead cranes for Cricklewood and Fortis Green pumping stations, also one Diesel engine and one 8-ton overhead crane for Green Street Green pumping station. Specifications and forms of tender from the Chief Engineer's Department, Savoy Court, Strand, W.C.

Bethnal Green.—April 2nd. Telephone cables, for the B. of G. See "Official Notices" March 15th.

St. Pancras.—April 15th. Lead-covered armoured cables, for the B.C. See "Official Notices" March 22nd.

H.M. Office of Works.—April 17th. Conduit boxes for two years. See "Official Notices" to-day.

Limerick.—April 5th. Stores for a year, for the Corporation Electricity Department. See "Official Notices" March 22nd.

Manchester.—April 4th. (*a*) Atmospheric pipe; (*b*) electric capstan; for the Corporation Electricity Committee. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

New Zealand.—May 1st and July 1st. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of pipe lines, valves, water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. The sections to be tendered for by July 1st are:—Lightning arresters, insulators, bare conductors, insulated cables, pole switches, testing transformers, supply meters, batteries and accessories. Particulars can be seen at Board of Trade Com. Int. Dept. in London. Tenders for the whole, or for any section, should be addressed to the Minister of Public Works, Wellington.

Partick.—April 2nd. Stores and materials for a year, for the Burgh Electricity Department. See "Official Notices" March 22nd.

Pilsen.—April 15th. Sundry machine tools with electric driving. Particulars from the K.K. Staatsbahndirektion, Pilsen.

Prague.—April 9th. Supply of electric machine tools for the local railway workshop. Particulars, K.K. Staatseisenbahndirektion, Abteilung IV, Prague.

Rawtenstall.—April 9th. Extensions to the generating station at Hareholme, near Waterfoot, for the T.C. Mr. C. L. E. Stewart, borough electrical engineer (returnable deposit of £2 2s.).

Rhodesia.—Salisbury.—April 15th. (1) Cables, poles, and line material; (2) power station equipment for lighting. London agents: Davis & Soper, 54, St. Mary Axe, E.C. Deposit £5. Must be British or British-Colonial manufacture.

Shanghai.—April 3rd. 945 single-phase A.C. house service meters, for the Municipal Council. See "Official Notices" March 22nd.

Spain.—April 3rd. The General Direccion de Correos y Telegrafos, in Madrid, are inviting tenders for the concession for the establishment and working, during a period of 20 years, of a telephone exchange in the town of Villafranca del Panndes (province of Barcelona).

Vienna.—April 15th. The Imperial and Royal State Railways Direction invite tenders for some 50 machine tools of various kinds, with electric driving equipment (including boring, shaping, riveting and leather-sewing machines, metal and wood circular saws, electric fans, portable electric dust-exhausters, eight cranes, &c.). Particulars, K.K. Direktion der Staatseisenbahnen, Schwartzenbergplatz 3, Vienna I.

Walsall.—April 22nd. Seven tramcar bodies, with trucks and equipment, for the Corporation. See "Official Notices" to-day.

West Hartlepool.—April 2nd. (*a*) 300-KW. storage battery and booster (*b*) rotary converting plant, for the Corporation Electricity Department. See "Official Notices" March 15th.

April 15th.—High and low-tension switchgear, for the Corporation Electricity Department. See "Official Notices" to-day.

York.—April 12th. Two water-tube boilers, with superheaters, automatic stokers, economiser and pipework, for the City Electricity Department. See "Official Notices" March 22nd.

CLOSED.

Aberdare.—The U.D.C. Electricity Department has placed the contracts for service material for the coming year as under:—

Cables.—Union Cable Co., Ltd., £166.
Meters and current limiters.—Siemens Bros., Ltd., £147.
Joint boxes, &c.—W. Lyon & Co., Ltd., £118.

Australia.—New South Wales.—The *Australian Mining Standard* records the placing of the following contracts:—

Telephone switchboard cable, and a large variety of telephone accessories.—Western Electric Co. (Australia), Ltd.
Various telephones, switchboards, apparatus and accessories.—James Paton & Co.
Coppers, leads, zincs, bells, electric lamps, binders, tapes, wire, &c.—Lawrence & Hanson Electrical Co., Ltd.
Glass tubes, detectors, instruments, staples, carbons, &c.—I.R., G.P. and T. Works, Ltd.
Condensers, resistance boxes, sounders, tapes, wire, &c.—B.I. and Helsby Cables, Ltd.
Galvanised iron wire, copper wire.—R. Johnson, Clapham & Morris, Ltd.
470 telephones.—British G.E.C. Co., Ltd.
14,000 connectors, resistance boxes, tape, &c.—Siemens Bros. Dynamo Works, Ltd.
14,000 Leclanché cells, carpieces, mouthpieces, &c.—W. G. Watson and Co., Ltd.
Salammoniac, &c.—J. Bartram & Sons Pty., Ltd.
Sulphate of magnesia, sleeves, &c.—Theodore Zwicker & Co.
Various wires (10, 2, 106 and 120 miles).—W. T. Henley's Telegraph Works Co., Ltd.
Brackets, shackles, switches, iron wire, &c.—Noyes Bros. (Sydney), Ltd.
4,500 dry cells.—British Ever-Ready Electrical Co., Ltd.
Postmaster-General's Department.—110,000 porcelain insulators, pattern "A," at 4½d. each.—Dalgety & Co., Ltd., Melbourne.
1,000 stay rods, ⅝ in., at 1s. 9d. each; 7,000 spindles, galvanised iron, swan neck, ⅝ in., at 5¾d. each.—British and Foreign Indent Co., Sydney.
75,000 binders, copper, for 300-lb. copper wire and pattern "A" insulator, at £2 1vs. per 1,000; 75,000 copper tapes, for 3.0-lb. wire, at £2 4 per 1,000.—British Insulated and Helsby Cables, Ltd., Melbourne.
7,000 sleeves, jointing, for use with hard-drawn copper wire of maximum diameter of 188 mils, at 11s. 3d. per 100; 2,700 sleeves, jointing, for use with galvanised iron line wire 0·1×1 in. in diameter, at £1 2s. 9d. per 100.—Theodore Zwicker & Co., Melbourne.
206 tons hard-drawn copper wire, 300 lb per mile, at £69 14s. per ton.—R. Johnson, Clapham & Morris, Ltd., Sydney.

Sydney.—City Council.—Direct-current meters, Ferranti, Ltd., for all sizes except the 5-ampere size, already accepted from W. G. Watson & Co.; the Australian General Electric Co., for all A.C. meters, with the exception of the various four-wire meters. —*Australian Mining Standard.*

Croydon.—The B. of G. has accepted the tender of Mr. W. Huntsman, of Islington, for electrical fittings.

Halifax.—The Council has accepted the tender of the Reason Manufacturing Co., Ltd., for the supply of electrolytic meters for the year.

Leeds.—The City Tramways Committee has accepted the tender of the Corona Lampworks, Ltd., London, for 10,000 Corona 1912 type annealed tungsten wire lamps.

London.—The tender of W. J. Fryer & Co., at £79, has been accepted by the Metropolitan Asylums Board, for carrying out supplementary electric lighting for staff cubicles at the Brook Hospital.

Southwark.—The B.C. has accepted the tender of the Electrical Engineering and Equipment Co., Ltd., at £961, for the supply of 560 yards of ·5 × ·2 × ·5 sq. in., 440 yards of ·3 × ·3 × ·125 sq. in., and 880 yards of ·2 × ·2 × ·075 sq. in. copper cable. Fourteen tenders were received at prices ranging from that accepted to £1,166.

Woolwich.—The B.C. has accepted the tenders of W. T. Henley's Telegraph Works Co., Ltd., and Siemens Bros. & Co., Ltd., at £1,394 and £1,848, respectively, for cable.

The electric light, power and telephone installation for new works of Zoechrome, Ltd., film manufacturers, at Tooting, has been awarded to Mr. H. J. Whitehead, of Wandsworth.

Merthyr Tydfil.—The B. of G. has accepted the tender of the Merthyr Electric Traction and Lighting Co. for electrical accessories.

Southend-on-Sea.—The T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for three bogie tramcars, at £596 each, and four single truck cars, at £535 each, with a carrying capacity of 70 and 56 persons respectively. All will be fitted with Brush motor equipments.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, April 1st.—"A" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.
Tuesday, April 2nd.—"B" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.
Thursday, April 4th.—"C" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.
Friday, April 5th.—Headquarters will be closed.
Saturday, April 6th.—Headquarters will be opened for the transaction of regimental business till 12 noon.

(Signed) P. H. S. Campbell, Capt. R.E. and Adjt.,
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, March 29th. At 8 p.m. At the Criterion Restaurant, Piccadilly Circus. Smoking concert.

Royal Institution.—Saturday, March 30th.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture VI.)

North-East Coast Institution of Engineers and Shipbuilders.—Monday, April 1st. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle-upon-Tyne. Discussion on "Relative Possibilities of the Diesel Oil Engine, Geared Turbine and Suction Gas Engine, as compared with the Reciprocating Engine, for Marine Propulsion," to be introduced by Mr. E. L. Orde (Diesel Oil Engine), the Hon. Sir Charles Parsons and Mr. R. J. Walker (Geared Turbine), and Mr. A. C. Holzapfel (Suction Gas Engine).

Smoke Abatement Exhibition.—Until April 4th, inclusive. At the Royal Agricultural Hall, London.

NOTES.

Social Events.—The first annual dinner of the Screw Machine and Drill Press Departments of the Western Electric Co., Ltd., was held at the Crown and Cushion Hotel, London Wall, E.C., on Saturday, the 16th inst., when about 35 representatives of the departments were present. The chair was taken by Mr. Pendar (foreman of the Screw Machine Department), assisted by Mr. Nye and Mr. Cooper, and after the dinner, a very successful smoking concert was given by the various members.

The fourth annual staff dinner of the South Metropolitan Electric Light and Power Co., was held in the Nelson room of the Trafalgar Hotel, East Greenwich, on the 20th inst. The chair was taken by the managing director and engineer-in-chief, Mr. H. W. Bowden, who, in proposing the toast of "The Company," remarked that the staff were to be congratulated on the improved position of the company, which this year's working had shown. It was gratifying to him to note the increased number who were able to be present, the attendance being over 50, which compared very favourably with previous years' figures. After dinner, the evening was devoted to a concert and whist drive.

Mr. A. C. Cramb (Borough Electrical Engineer) presided at the staff dinner of the Croydon Corporation Electricity Works, which was attended by the Mayor (Ald. J. Trumble), and many members of the Council and officials. The chairman claimed that electric current was supplied in Croydon at charges comparing very favourably with those of towns where coal was much cheaper. If they kept their capital charges down he did not see why further reductions should not be made. At the same time he believed that Parliament, in granting to municipalities powers for electric supply, had in mind the production of current as cheaply as possible, and he felt that before long the Legislature would prevent municipal electricity undertakings being drained for the relief of the rates in the manner they had been in the past. The principle of municipal trading was that the best quality commodity should be supplied at the lowest possible price. The Mayor believed the time would come when more could be done for the consumers, but it would not be at the expense of the employés. Proposing "The Lighting and Electricity Committee," Mr. Cramb said that as a rule there was not the close personal interest evinced in a municipal trading concern that there was in a public company; but in Croydon they approached very nearly, if not quite, to that level. Alderman D. B. Miller (Chairman of the Committee), in replying, said he was certainly opposed to the principle that municipal undertakings should be run primarily to aid the rates. He agreed with Mr. Cramb's desire to see more industries established in Croydon. Their engineer-in-chief was the best they had ever had, and the department owed its great success to him, with the co-operation of a loyal staff.

The British Westinghouse Engineers' Club held their sixth annual dinner at the Midland Hotel, Manchester, on Friday, March 22nd. Mr. J. H. Tearle occupied the chair, being supported by Mr. Ph. A. Large and Mr. W. W. Blunt. After an enjoyable repast and the loyal toast, telegrams from several absent members were read. The toast of "The Company" was proposed by Mr. A. E. Soanes, who dealt with the position and future of the company. In reply, Mr. Lange remarked on the effect of the coal strike, and also assured the members of the club of the interest of the directors in their project for new headquarters. Mr. Lange also read an interesting letter which Mr. E. M. Herr, president of the American Co., issued to all the employés of that company when he assumed office. Mr. H. Mensforth next proposed the toast of "The Commercial Departments," on behalf of which Mr. Blunt replied. "The Engineers' Club and Foremen's Association" were proposed by Mr. J. C. Whitmoyer, and replied to by Messrs. Tearle and F. Swann. The proceedings were enlivened by several musical items by the following members of the company:—Messrs. F. A. Broadhurst, E. M. Johnson, T. M. Kirkby, E. H. Muller, and R. H. Thistlethwaite. Mr. D. Jenkins gave his services at the piano.

The employés of Messrs. Elliott Bros., Century Works, Lewisham, held their annual social gathering on March 23rd. The Blackheath Concert Hall, which is the largest hall available in the neighbourhood, was filled to its utmost capacity—over 600 being present—and a most enjoyable evening was spent. As on previous occasions, a number of local residents kindly contributed to the entertainment which consisted of "The Pom-Pom Pierrots" for the first part, and the well-known farce in three acts, "The Arabian Nights," for the second part. During the interval refreshments were served, and throughout the evening the works orchestra performed selections of music. All the arrangements were carried through without a hitch under the supervision of the "Amusements Committee," which is a permanent institution to supervise all matters of welfare among the employés.

On Thursday last week the annual staff supper and dance of the Greenock Corporation Electricity Department was held, Mr. J. A. Robertson, burgh electrical engineer, presiding. The toast of "The Electricity Department" was proposed by Mr. W. Nicoll and responded to by ex-Bailie J. W. Bailey, convener of the electricity department. In the course of the speeches many things were said appreciative of Mr. Robertson, and one speaker let drop a whisper "That Mr. Robertson was leaving Greenock."

Copper.—Up to the date of issue of Messrs. Merton's last statistical circular, the influence of the general depression on the metal markets had not been severe. From the figures given we find that visible supplies fell 579 tons during the first fortnight in March, this being due to withdrawals from English stock, and lower Australian shipments.

Supplies, on the whole, are fairly brisk at 22,082 tons, deliveries for half-month being 22,661. North American exports to Europe show average, Spain and Portugal low, Chile shipments low, and Australian rather below average. The above are on mid-monthly figures only; a slight falling-off would be expected after the heavy deliveries of last month.

The American visible supplies are beginning to show reduction, being at 28,098 tons for end of March, a withdrawal of 1,491 tons during the month. The world's visible supply stands at little over half what it was last February, when the price was £54 15s.

Rotterdam stocks show 100 tons less than for end of March, and Hamburg (estimated) 300 tons less.

The Australian Electrical Wages Board.—The *Australian Mining Standard* publishes the first portion of the award of the Victorian Wages Board appointed to fix the rates of pay for men employed on electrical installation work. The award was to come into force on March 11th. It fixes the following rates for a week of 48 hours:—

"Electrical mechanics or wiremen and linesmen, 63s.

"Cable-joiners, 69s.

"Electrical fitters, engaged in electrical work mainly carried out in a workshop, including making or repairing electrical instruments or apparatus of all kinds, 66s.

"Patrol men, engaged in patrolling and effecting repairs to external electric supply or transmission mains, 63s.

"Persons attending to consumers' complaints regarding faults on installation and private arc circuits, or effecting temporary repairs, 54s.

"Leading hands in the above cases respectively, *i.e.*, journeymen (*a*) who are placed in charge of two or more journeymen; (*b*) who, where three or more journeymen are employed, receive orders from an officer, or from a foreman, who may not be continually on the works, to direct the work generally, in the absence of such officer or foreman, 1s. per day, in addition to the rate specified.

"Electrical labourers, *i.e.*, persons engaged in any work (not requiring knowledge of electricity) carried out under the direct supervision or direction of an electrical mechanic, 54s.

"Boys of 14 or 15 years of age (not being apprentices or improvers) engaged in waiting on workmen, cleaning tools, &c.:—First six months' experience, 5s.; second, 7s. 6d.; third, 10s.; fourth, 12s. 6d.

"The number of apprentices who may be employed is fixed at one to every three workers, or fraction of three workers, receiving 54s. per week, or earning at piecework rate not less than that wage.

"The employment of improvers is limited to one to one, two or three journeymen, and thereafter one improver to every three journeymen receiving not less than 63s. The wages of apprentices range from 5s. in the first year to 45s. in the fifth. The rates for improvers rise from 7s. 6d. to 48s. Special rates are fixed for overtime and for holiday work."

Illegally Abstracting Electricity.—A Farnworth tradesman was fined 5s. and costs at Bolton Police Court on Monday for illegally abstracting electricity from the District Council mains. It was stated that the District Council's engineer visited his premises on February 27th and found electric lights burning in the kitchen. When the current was switched off next door the light disappeared. It was afterwards found that while the defendant was taking supplies for power a sub-connection had been made whereby he was able to get current for lighting without its passing through the meter. Even if it had been allowed to pass through the power meter the man would still have been defrauding the Council, inasmuch as there was a difference of 2d. per unit in the cost of electricity for lighting and for power. The defendant stated that he had not offended "with any wrong intention." He was aware that he was getting light for nothing.

Alleged Damage to Tramway Track.—Greenock and Port Glasgow Tramways Co. recently sought to interdict two local firms from using certain streets for the cartage of heavy boilers and machinery, particularly over those portions where the tramlines pass. Damages were also claimed for alleged destruction of the causeway setts along the track by what was termed extraordinary traffic. Sheriff Welsh on Monday refused interdict, holding that it had not been proved that the passage of defenders' traction engines of themselves caused the damage complained of, nor had it been proved that the loads exceeded the limits allowed by Sec. 4 of the Locomotive Act, 1865. Pursuers were found liable to defenders in expenses.

Electrical Trades Benevolent Institution.—The annual report and accounts of the Committee for the year ended December 31st, 1911, were adopted at the meeting held at the I.E.E., Victoria Embankment on Wednesday.

It is stated that the year was one of the most successful in the records of the Institution, this being largely due to the Gustav Byng bequest and the receipt of the balance of the surplus proceeds from the 1905 Electrical Exhibition at Olympia. The amount of the annual subscriptions also increased from £49 to £82, with a large increase in the number of subscribers. As a result of the year's work £920 has been expended beneficially in furthering the objects of the Institution, £885 being carried to the balance-sheet and £35 expended in grants for temporary relief. £1,000 of Western Australia 3½ per cent. inscribed stock was purchased, and the amount of the investments has been thereby raised from £2,285 to £3,248. Five grants for temporary relief were made, and employment was found for three of these applicants. Grants were made to every applicant who was eligible, but the Committee remark that it is surprising that so few applications were made. They consider that it is of vital importance to secure sufficient invested funds to produce a revenue from which pensions can be paid, rather than to increase the amount given in grants for temporary relief. We make the following extracts from the report on one or two interesting points:—

"Your committee lay it down as a rule that under no circumstances should pensions be promised or granted excepting when their payment can be made out of the revenue from invested funds. This gives the institution a stability which it cannot otherwise have, and when such stability is fully realised, benevolent persons will give it greater support.

"The invested funds, although growing steadily, are not increasing with the rapidity which is essential, in view of the demand for pensions which may be expected in the near future, and the granting of pensions must undoubtedly be the primary object of the institution.

"The Committee trust that this institution will be remembered by the wealthy members of the industry when making testamentary distribution of their property.

"A sub-committee was appointed to consider the revision of the rules, and also to consider arrangements for collections in offices. In order to carry out in a thorough manner the objects to be attained, the Secretary interviewed several of the secretaries of similar institutions, and also obtained copies of the rules of a large number of such institutions.

"The new rules," which were confirmed at the annual general meeting will, it is believed, "have an important effect on the success of the Institution, embodying as they do a definite membership, while for the first time provision has been made for systematic collection from small contributors as well as for a scheme of life assurance, under which members will be able to obtain special terms and privileges.

"Some of the actual subscribers, and others who are possible subscribers to this Institution, have unfortunately had the impression that its benefits would be unnecessary in view of those which may accrue under the new National Insurance Act. Such is, however, not the case, for there are but few who are included in the list of those eligible for pensions who would be eligible for benefits under the Insurance Act. The benefits are, moreover, of a very different scope and character."

The meeting proceeded with the election of the Committee of Management. We shall publish the alterations later Messrs. Price, Waterhouse & Co., were elected auditors to the Institution.

Cookery Demonstrations.—In addition to the exhibits at the Smoke Abatement Exhibition, an independent display of electric cooking has been in progress in Islington during this week. The demonstration has been organised by the Lighting Committee of the borough, with the collaboration of the Berry Construction Co., Ltd., at the Central Library, Holloway Road, and was opened on Tuesday by the Mayor. The concluding demonstrations will be given to-day at 3.30 and 7.30 p.m.

The Berry Construction Co. has also established a public electric kitchen at the "London Louvre," in Oxford Street—that is, a complete installation of "Tricity" cooking apparatus, on which demonstrations are given practically throughout the day by a special staff, with a view to educating the public to the advantages and excellences of electric cooking. The kitchen is admirably situated to a large show window, in which its appetising products are displayed, and visitors are welcomed, the whole object of the installation being to explain to them individually the distinguishing features of the system. A showcase at the other entrance of "The Louvre" is kept stocked with joints, cakes, &c., cooked in the "Modern Kitchen," as it is called, which are changed daily. We understand that already visitors have manifested great interest in the demonstrations and the latter will form a permanent show, maintained at a heavy cost by the company.

We must congratulate Mr. Berry upon the courage and enterprise with which he has embarked upon this costly venture—though the fact that 4,000 "Tricity" ovens have already been sold, no doubt justifies his confidence. As the demonstrations will continue after the Smoke Abatement Exhibition is over, and are open to all comers, they will prove extremely useful to central-station managers, who will, no doubt, find it greatly to their advantage to send their prospective clients to "Modern Kitchens" to see for themselves how it is done.

Annual Dinners.—The Association of Engineers-in-Charge held its annual dinner last Saturday evening at the Holborn Restaurant. About 250 persons were present, and the President, Mr. W. H. Maw, was supported by such representative men as Dr. W. C. Unwin, the President of the Institution of Civil Engineers, his Honour Judge Rentoul, K.C., Capt. Sankey, R.E., Mr. H. Hirst, Mr. Henry Adam, Mr. Arthur Davey, Sir Ernest Shackelton, C.V.O., Mr. A. E. Renn, Mr. Alexander Siemens, Dr. H. S. Hele-Shaw, &c.

After the usual loyal toasts, Dr. Unwin proposed the toast of "The Association." He pointed out that he understood that the Society had been formed to help engineers to do their work better. He fully appreciated the importance of the duties of the engineer-in-charge of the plant of a large institution or industrial establishment, and realised that a considerable amount of knowledge was absolutely necessary. No one ever succeeded on his own experience alone; he was bound to rely to a large extent on that of others, therefore the discussions which took place at their meetings was good, and he especially commended their custom of holding special meetings where they retailed to one another their experiences with the plant under their charge. Dr. Unwin then touched upon the importance of thoroughly understanding the reason why things happened, and urged all to cultivate the habit of clear thinking. He illustrated his meaning by referring to the subject of superheated steam. First brought to the front in this country, failures in using it caused its practical abandonment. Continental engineers studied the matter, were convinced of its advantages, and its use became general in Alsace before British engineers tried it again. It was the same in other directions. Unless we did more clear thinking and worked intelligently, we should find our competitors forging ahead of us. The society existed to prevent this, and he heartily wished it success. The President (Mr. Maw) in replying, pointed out that the society had a well-defined sphere of operation, and was trying to successfully fill it. Large sums of money were lost every year because valuable plant was not used to the best advantage. Their province was to train those in charge of such plant so that they could make the very best use of the machinery under their care. In view of the practical value of many of their discussions, he thought the time was fast coming when they should get the various speeches reported for the benefit of members not able to attend.

The toast of "Kindred Institutions" was proposed by Mr. A. Davey, and responded to by Captain Sankey, and Sir Ernest Shackleton. Captain Sankey pointed out the uselessness of good plant unless intelligently used, and Sir Ernest Shackleton referred to the invaluable help the engineer gave to the explorer. Mr. Capsey, the late hon. secretary, proposed thetoast of "The Guests," which was acknowledged by Mr. H. Hirst, and his Honour Judge Rentoul.

An excellent musical programme interspersed the speeches, and great credit is due to Mr. Singleton (the new hon. secretary) for the care with which the various arrangements had been made.

The annual dinner of the Nottingham Society of Engineers, held at the Victoria Station Hotel, Nottingham, on Friday evening, was attended by a company numbering 150. The President (Mr. F. W. Davis) occupied the chair. The toast of "The Imperial Forces" was proposed by Col. Sir L. Rolleston, who spoke on the question of compulsory service. Col. G. M. Jackon (Clay Cross) responded, and urged on employers the wisdom of giving every facility to their workmen for joining the Territorials. "The Civic Toast," proposed by the Rev. F. W. Paul, was acknowledged by the Mayor and Sheriff, the former speaking of the work of the civil engineering staff in connection with the Derwent Valley water scheme. Councillor Foulds proposed "The Toast of the Society," the chairman responding, and Mr. Crawford (president elect) submitted the toast of "Kindred Societies." A capital musical programme was provided.

Mr. W. A. Baxter presided at the fifth annual dinner of the Birmingham Branch of the Electrical Contractors' Association, held at the Imperial Hotel, Birmingham, last week. The toast of "The Electrical Industry," was proposed by Mr. N. B. Rosher. Mr. Foulds (secretary of the Birmingham Electricity Department), in replying to the toast, said the electricity department, in spite of the strike, were in a very fortunate position, for they had more coal now than at the beginning of the strike, and they could go on for at least two months.

Inquiry.—A correspondent sends the following query:—

"For certain apparatus which has been planned it is necessary to have an electric potential sufficiently high to give a 'cold' (i.e., one that does not produce any considerable heating of the electrodes) oscillatory spark several inches in length. There are three requirements of the apparatus: (1) the induction coil or transformer must be light, not weighing more than 30 or 40 lb.; (2) it must be able to run continuously for weeks or months at a time; (3) the current consumption should not be more than 1 or 2 amperes at 110 volts.

"The difficulty met in the case of induction coils is that the interrupter will get out of order, and requires considerable attention. Transformers are too heavy if they give sufficient voltage. The discharge is usually of a flamatory character, and produces heating of the electrodes. If capacity is inserted in the circuit the sparking distance is greatly reduced.

"Could you advise the use of any kind of apparatus that fulfils some, or all, of the above conditions? Would any kind of induction coil that you know of give a sufficiently long spark if run on 220 A.C. with incandescent lamp resistance in series in the primary, no interrupter being used?"

Will.—Mr. John Nevin, chairman of the Electrical Distribution of Yorkshire, Ltd., left £54,617 gross, with net personalty £47,422.

Smoke Abatement Exhibition.—On Wednesday a conversazione was held in connection with the Electrical Section at the Exhibition; the President and Mrs. Ferranti received the guests in the Exhibition Reception Room, and afternoon tea was served. The President then made an inspection of the Electricity Hall, and at 5.30 p.m. he gave a short address in the Berners Hall, which was followed by an illustrated lecture delivered by Mr. Frank Bailey, on "Electricity—Lighting, Heating and Power." The function was well attended and very successful.

Chilean Railway Electrification.—With reference to the article on page 453 of our last issue, the following has come to hand at the moment of going to press from the Legacion de Chile, 48, Grosvenor Square, W.:—

"I am directed by the Chilean Minister to inform you in regard to a publication made in your issue of the 22nd inst. that this Legation has not received from the Chilean Government any instructions whatsoever concerning the proposed electrification of the Chilean State Railways. Kindly correct this misstatement in your next issue and oblige, yours faithfully,

"Enrique Cuevas, *First Secretary.*

"*March 27th*, 1912."

Appointments Vacant.—Junior shift engineer, for the Corporation electricity works, St. Helens (32s.); commercial assistant, for the Borough electric light and power department, Gillingham (£100); telegraph construction foreman, for the Ceylon Government (£250). See our advertisement pages to-day.

Marconi Extensions in the U.S.A.—A correspondent of the *Times* reports that the Marconi Wireless Telegraph Co., of America, is going to increase its capital to two millions sterling, and will erect a powerful station near New York City, which will be able to communicate with the one to be erected near London

Institution and Lecture Notes.—Institution of Civil Engineers.—The annual dinner of the Institution was held last week at Lincoln's Inn Hall. Dr. W. C. Unwin, F.R.S., the President, occupied the chair, and in proposing the toast of "The Universities and Applied Science," said that the divorce between science and practice had ended, and now they had engineering schools in every University in the United Kingdom. They were making rapid strides in their attempt to overtake the German engineering schools. Sir William Ramsay, who responded, said that nothing was impossible to the constructional engineer; the question which they had to consider was, not whether the thing could be done, but whether it would pay.

Justice to Ireland.—A correspondent in County Dublin (Mr. E. N. Allan, A.M.I.E.E.), whose letter reached us after our "Correspondence" columns had been closed, complains bitterly of some expressions in our leader on "Peat Fuel," which, he considers, contain reflections upon the Irish character. The remarks in question were not intended to be taken seriously, but we agree that if they are so taken, they are offensive, and we regret that they were allowed to appear in our pages. Our correspondent goes on to say that many years ago the cultivation of reclaimed bogland was tried in Ireland, but the soil was found to be so useless that nothing would grow on it except a kind of grass of no value whatever. The Dutch, he thinks, must have been particularly fortunate; but it does not follow that, because they offered to reclaim bogland in Ireland, they would have successfully carried it out.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements*

Central Station Officials.—The following alterations in salaries in the Hackney B.C. Electricity Department are recommended:—Mr. T. Dalby, works superintendent, to be advanced from £200 by annual increments of £12 10s. up to £250 maximum. Mr. E. Mathews, testing engineer, to be advanced from £130 per annum, by annual increments of £10 to £180. Mr. E. Wilkinson, deputy generating engineer, to be advanced from £117 per annum to £130. Mr. C. Lill, sales engineer, to be advanced from £150 per annum by annual increments of £10 to £200. Mr. J. H. Heathman, senior general clerk, is now to be designated Chief Clerk to the Electricity Department.

The Swansea Council will increase the salary of the electrical engineer, Mr. C. A. L. Prusmann, by £50 per annum.

The Carlisle T.C. has adopted the recommendation of the Electricity Committee increasing the salary of Mr. Barham, station superintendent, from £120 to £130, rising by £5 a year to £150.

The Rawtenstall T.C. has amended the duties of the borough electrical and tramways engineer (Mr. C. L. E. Stewart) from April 1st, so as to include all services which may in future be required of him by the Council and all its Committees and special Sub-Committees, including the street lighting, education, and all other departments. The salary has been increased, as from April 1st, to £300, rising to £400 by £25 a year, on condition that Mr. Stewart agrees to stay with the Council for four years from April 1st.

Tramway Officials.—Mr. H. Wilson, assistant traffic superintendent of the Sheffield tramways, has been presented with a case of cutlery by the members of the Tramway Employés Club, in recognition of eight years' service as trustee.

General.—The King has given authority to Mr. Joseph Macnamara, chief electrical engineer in the Egyptian Railway department, to accept and wear the Insignia of the Fourth Class of the Imperial Ottoman Order of the Osmanieh conferred upon him by the Sultan of Turkey in recognition of valuable services rendered by him.

Mr. A. S. Duncan and Mr. A. Podmore, members of the National Telephone Co.'s engineering staff, who were transferred to the Post Office, have been appointed assistant electrician and assistant engineer respectively to the Constantinople Telephone Co. (Société Anonyme Ottomane des Téléphones de Constantinople), and they will shortly proceed to Constantinople to take up their duties.

Messrs. R. D. McCarter and James Kerr Bock, have removed from Finsbury Pavement, E.C., to Donnington House, Norfolk Street, W.C.

The Right Hon. Lord Ampthill, G.C.I.E., G.C.S.I., F.R.G.S., etc., has accepted the Presidency of the British Electrical and Allied Manufacturers' Association (Incorporated).

The *Australian Mining Standard* says it is rumoured in electrical circles in Melbourne that Mr. G. G. Balsillie, the Commonwealth wireless expert, appointed but a few months ago, and under whose direction the new stations are being erected, has been approached by the Marconi Wireless Telegraph Co., with a view to his taking up the management of that company's affairs in Australasia.

Mr. Wm. Anthony Brown, of Messrs. Hooghwinkel, Anthony Brown & Partners, is leaving by the R.M.S.P. Co.'s steamer *Avon* on 29th inst., for South America in connection with various engineering works in which his firm are interested.

Mr. W. Stone, electrical expert for the Victorian railways, left Sydney on February 11th by the *Makura* for America, and he will proceed to London, to confer with Mr. Merz on the electrification of the railway services.

Obituary.—Antonio Pacinotti.—We deeply regret to record the death at the age of 71 of Signor Antonio Pacinotti, who, for many years, had been renowned as the Professor of Physics at the University of Pisa, the city of his birth. It was in the year 1860, when he was only 19 years of age, that Pacinotti constructed, at the expense of the Cabinet of Technological Physics of the above University, the chief of the machines which established his reputation as a pioneer in dynamo-electrical machine design. This machine, which preceded Gramme's dynamo by some 11 years, had a ring armature wound upon a core with projecting teeth, and it was an immense advance upon previous inventions, for it embodied the main principles of present-day continuous-current motors. Pacinotti was assisted in the construction of this machine by Guiseppe Paggioli. This, with other pieces of apparatus, was sent by Pacinotti to the International Exhibition of Electricity in Paris in 1881. The 1860 machine was produced there as evidence of Pacinotti's priority as against Gramme, in the construction of field magnets transverse to the ring, and in their use, both for obtaining mechanical work from the electric current and for obtaining a continuous induced current from mechanical work. In 1873 Pacinotti constructed a magneto-electric machine. In 1878 at Cagliari, in the Doghio workshop, Pacinotti constructed a magneto-electric machine with a transverse ring, the first attempts at which he had made at Pisa three years previously. Another of his exhibits at Paris in 1881 was a pair of discs for the study of the electricity developed by molecular attraction. Pacinotti's work was very fully described in the pages of this journal (the Telegraphic Journal and Electrical Review) in 1881, at the time of the Paris Exhibition, as well as in earlier issues.

CITY NOTES.

North of Scotland Electric Light and Power Co., Ltd.

The directors' report for the year ended December 31st, 1911, records satisfactory progress. The gross profit, including £773 brought forward from last year, is £6,554, and after meeting interest paid on debentures and loans, amounting to £2,861, and writing off £31 balance of street-lighting alterations and £10 loss on meters destroyed by fire, there remains a net profit of £3,653. It is proposed to carry £2,000 to the renewal reserve account, and the balance of £1,653 forward. £11,115 of debenture stock has been issued during the year.

	Montrose.	Brechin.	Inverness.
Units generated	276,528	189,938	530,240
Units sold—			
Public lamps	60,050	30,178	—
Private consumers ..	162,054	108,677	443,654
Used on works	45,418	41,031	65,403
Total accounted for ..	267,522	179,886	509,057
Not accounted for ..	9,006	10,052	21,183
Number of public lamps ..	Arcs, 20; 50-c.p. M.F., 245; 16-c.p., 62; 8-c.p., 20.	50-c.p. M.F., 134; 10-c.p., 121; 16-c.p., 3.	—
Total maximum supply demanded	163 kw.	101·6 kw.	324 kw.
Year of working	Tenth	Tenth	Sixth
Lamps connected Jan. 1st	23,175	13,576	25,946
Lamps connected Dec. 31st	23,632	14,000	29,000

Gateshead District Tramways Co., Ltd.

The annual general meeting was held on Thursday last week at the Electrical Federation Offices, W.C., Mr. C. R. Greene presiding.

In moving the adoption of the report (see Electrical Review, page 435), the Chairman said the traffic receipts had increased by £2,850, and that extra traffic, representing 643,928 passengers, was dealt with, at an increased cost in power and running of only £77. The expenditure on repairs and maintenance was £1,020 larger than in 1910. Many of the cars had been in service for 12 years, and now required a considerable expenditure on the bodies and equipments. That work was being continued, and they must naturally expect the cost under that head to be heavy during the next few years. During the latter part of the year the company had installed meters on the tramcars. The results during the period under review were satisfactory, and it was hoped that during the current year still more favourable results would be obtained. The question of the wages of employés received the attention of the directors, and increases were given to drivers and conductors, and certain concessions to other employés, which resulted in an immediate addition to the wages bill of about £325 per annum. The results for the year's working had been most satisfactory, the net profit being the highest in the history of the company. Trade in the district throughout the period under review was excellent, and the strike of railway employés in August last in no way interfered with the traffics. On the contrary, throughout the period an increase in the receipts were shown. After providing for the usual dividends on the 5 per cent. and 6 per cent. preference shares, a dividend was paid at the rate of 6 per cent. per annum for the year on the ordinary shares, and £1,878, equal to nearly 1½ per cent. dividend on the ordinary shares, was carried forward. The amount carried forward was large, but in view of the present unrest in the industrial world the directors considered it advisable to preserve the resources of the company. Gateshead, with all other towns in the district, was seriously affected by the coal strike, but he was pleased to say that their traffic receipts had, so far, shown only a small decrease. As stated in the report, after the appropriations had been made to the reserve, renewal and sinking funds, the total of those accounts would amount to £51,932. The investments, which were all in trustee securities, amounted to £19,039, and interest amounted to £697 on those investments, and had been carried direct to the renewal and reserve accounts instead of being taken into the profit and loss accounts as in previous years. Arrangements had been made with the "P.A.Y.E." London Syndicate for the conversion experimentally of nine cars operating on the Bensham and Saltwell routes to the "Pay-as-you-enter" system. The platforms of the cars were now being extended so as to provide separate and distinct entrance and exits. The conductor remained upon the rear platform and collected the fares as the passenger passed into the car. By the adoption of that type of car the company expected to provide a better service with greater safety and comfort and convenience to the passengers. The operation of the cars was intended to accomplish four important results. First the prevention of accidents through the starting of cars while passengers were in the act of boarding and alighting; second, facilitating the collection of fares and enabling the conductor to give more complete attention to the operating of his car; third, increasing the comfort of the passenger by doing away with the necessity of conductors at busy times having to struggle past passengers in the body of the car while collecting fares; and fourth, to assist in giving a better and quicker service to the public by reducing the total time taken by the loading and unloading of cars.

Mr. H. Day seconded the resolution, and the report was adopted.

Victoria Falls Co.'s New Capital.—It is reported from Berlin that the quotations on the Exchange for the debentures of the Victoria Falls and Transvaal Power Co., of which an extensive holding is in German ownership, have recently experienced a slow decline. A Berlin newspaper learns from quarters closely associated with the company that the fall in price is connected with the circumstance that consideration is being given to the question as to whether the company's new capital requirements are to be met by the issue of second debentures or new shares. It is added, however, that neither of the securities would be intended for the Berlin Stock Exchange.

Wemyss and District Tramways Co., Ltd.—In the sixth annual report, it is stated that the traffic receipts for the year amounted to £13,925, an increase of £349 as compared with the previous year. The total income was £14,209, and the balance at credit £2,763, after paying the interest on mortgage debenture stock and writing off £1,004 against the special expenditure incurred in 1909. A dividend of 6 per cent. on the ordinary shares is recommended.

Salisbury Electric Light and Supply Co., Ltd.—At the annual meeting, the chairman said that the plant, as stated in the report, was kept up in every possible way. It was in good working order, and capable of dealing with a considerably increased demand, and it was satisfactory to find that, although perhaps the improvement was not large, the position improved year by year, in spite of opposition and different adverse causes.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended March 1st, 1912, was 324,551, compared with 369,986 units in the corresponding five weeks of 1911.

Direct Spanish Telegraph Co., Ltd.

Sir J. Denison Pender, K.C.M.G., presided at Electra House, Finsbury Pavement, E.C., on March 20th, at the meeting of this company.

In moving the adoption of the report (see Electrical Review, page 434), he first referred to the death of the Marquis of Tweeddale, and to the election of Sir Albert Leppoe Cappel to the board. The traffic receipts for the year showed an increase of £194, which in view of the fact that they compared with a substantial increase in 1910 over 1909, was very satisfactory. The working expenses showed an increase of £144, but the increase would have been considerably higher but for the fact that they had been able to make savings under several heads. Repairs and maintenance of instruments, &c., had decreased by £131, due to the fact that the expenditure necessary in 1910 on the repair of overhead lines did not recur. Having referred to the expenditure on drainage necessitated on the renewal of the company's Gracechurch Street premises, the Chairman called attention to the fact that to commemorate the Coronation of the King every employé with over a year's service had received a bonus of a month's wages. The board were very pleased to confer this benefit to mark their appreciation of the loyal services rendered by the staff. The Bilbao cable again became interrupted on June 28th, but it was quickly repaired at a cost of £4,124, which had been paid out of revenue. It would be within their recollection that the Bilbao cable had been frequently interrupted in the last few years, and had necessitated a heavy expenditure for repairs. Therefore, the directors had considered carefully the question of the renewal, and decided to carry this out, and the work was done in September and October of last year. The cost of the operations came to the very considerable sum of £33,000, and it was intended to gradually repay this sum out of the reserve fund. At the last meeting it was explained that owing to the general deterioration of the company's underground line between Falmouth and the Lizard, which had been used since 1881, it had been thought advisable to transfer the company's telegraph station from Falmouth to Kuggar, which was about a quarter of a mile from the landing place. The overhead wire from London, which was leased by the company from the Post Office, had now been extended from Falmouth to Kuggar, this being considered more reliable, as well as cheaper. The company's old underground line between Falmouth and the Lizard, laid in 1881, having been taken out of circuit, the original cost of the line, viz., £2,710, had been deducted from the capital expenditure account, and the cost of the land purchased by the company at Kuggar, and the new telegraph station erected thereon, had been added to that account. The actual cost of the renewal was about £1,225. The reserve fund on December 31st amounted to £65,880 at cost price, but the securities showed a depreciation of 13 per cent., this being practically the same figure as at December, 1910. The result of their operations was that after paying the sum necessary for interest, and the redemption of debentures, and transferring £5,000 to reserve, they were able, in addition, to pay 10 per cent. on the preference shares, and the usual 4 per cent. on the ordinary shares, leaving £35 to be carried forward.

Mr. F. A. Johnston seconded the motion, and the report was adopted without discussion.

Urban Electric Supply Co., Ltd.—A special meeting of the preference shareholders was held on Thursday last week at Salisbury House, E.C., and in the absence of Mr. Tuckett, Mr. F. E. Gripper presided, and proposed a resolution sanctioning the alterations and modifications of the rights of the holders of the preference shares effected by the resolutions passed recently at an extraordinary general meeting. Mr. Charrington seconded the resolution, and it was adopted.

Rothesay Tramways Co., Ltd.—The report for 1911 states that after providing for renewals and depreciation the accounts show an available sum of £1,265. £200 has been placed to depreciation and reserve, and 5 per cent. paid on the preference shares, £165 being carried forward.

Airdrie and Coatbridge Tramways Co.—The directors' report states that the accounts for the year to December 31st show a profit, including £296 brought forward of £2,950. The directors have placed £600 to depreciation and reserve, and recommend a dividend of 4 per cent. £463 is to be carried forward.

Commonwealth Edison Co.—The report states (says the *Financier*) that the accounts for the 15 months to December 31st show a total income of $6,617,552, and, after providing for bond interest, placing $680,000 to depreciation reserve and setting aside $2,712,315 for dividends, there remains a surplus of $1,305,293 increasing the credit to profit and loss to $4,330,701.

Mexican Light and Power Co., Ltd.—The directors announce a dividend of 1 per cent. for the quarter to March 31st.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent.

Robey & Co., Ltd.—The directors announce a dividend of 6s. per share on the ordinary shares for 1911

Folkestone Electricity Supply Co., Ltd.

The directors report that the company continues to make satisfactory progress. Up to December 31st, 1911, the equivalent of 124,149 8-c.p. lamps was being supplied, being an increase of the equivalent of 6,100 8-c.p. lamps over those connected at December 31st, 1910. Including the receipts from hired installations, the profit on the revenue accounts for the three undertakings amounts to £16,242. This amount, with the sum of £349 brought forward and interest and installation profits, and after allowing for interest on debenture stock and dividend on preference shares, shows a balance of £9,913. Out of this an interim dividend at the rate of 6 per cent. per annum has been paid on the ordinary shares, and £6,058 has been carried to the depreciation fund, making this fund now £23,803 net, the sum of £500 to the reserve fund, making this fund now £4,100; and they recommend the payment of a dividend at the rate of 6 per cent. per annum (less income-tax) on the ordinary shares for the half-year (making 6 per cent. for the year), which will require £1,500, thus leaving £355 to be carried forward. The whole of the company's debenture stock has now been issued, and the balance of this stock has been taken up with practically no expense to the company. The directors report the death of Mr. C. J. Pursey, who had been a director of the company since its incorporation. Mr. Loftus Banks, of Folkestone, has been elected to the board.

Units generated	1,903,749
Quantity sold—Public lamps	76,100
By contract	419,678
Private consumers by meter	1,041,892
Total sold	1,537,670
Used on works	31,200
Total accounted for	1,568,870
Not accounted for	334,879
Public lamps	Arcs 88, incan. 455 (M.P.)
Maximum supply demanded, kw.	1,211

The meeting is to be held to-morrow, Saturday.

Bromley (Kent) Electric Light and Power Co., Ltd.

—The directors' report for 1911 states that the lamp connections have increased from 95,307 to 101,276. The sale of current has increased from £15,865 to £16,418. The works have been maintained in good order and repair. The result of the year's trading, including £185 brought forward from last year, shows a profit of £12,683, and after payment of debenture interest and trustees' fees, amounting to £3,139, and writing off one-third of the cost of motor-car, there is a balance of £9,463. An interim dividend at the rate of 4 per cent. per annum was paid for the half-year in October, and the directors recommend the payment of a further dividend for the second half-year at the rate of 8 per cent. per annum, making a total dividend of 6 per cent. for the year. £1,260 is to be placed to reserve account for renewal of plant, and £3,000 to general reserve fund, leaving a balance of £703 to be carried forward.

Vickers, Ltd.—The directors report for 1911 a substantial improvement over 1910. All the chief departments were working at full time throughout the year. Further important orders were secured, and a considerable proportion of them were derived from foreign countries. Before arriving at the profits depreciation has been provided for on a liberal scale. The directors have applied £100,000 to writing off goodwill and patents, and this item now disappears from the balance-sheet. After meeting preference dividend, the total ordinary dividend is 10 per cent. for the year, and there is carried forward £205,031.

Puebla Tramway Light and Power Co. — The directors' report states that the net profits in Mexico for 1911 were £67,039, as against £61,677 for 1910, £48,677 for 1909, and £27,354 for 1908. After meeting expenses and bond and interest charges, there remains a balance of profit of £7,329. The gross and net receipts of the light and tramway business show satisfactory increases, but, says the *Financial News*, little improvement is noticeable in the power section, due principally to the unsettled state of the country. The directors, having obtained the consent of the holders of more than two-thirds of the first mortgage gold bonds, created an issue of $6,000,000 prior lien 50-year 5 per cent. gold bonds, secured under trust deed in favour of National Trust Co., Ltd., of Toronto, and of this issue they sold $3,000,000 in December last. Out of the proceeds of this sale the directors have completed the purchase of the whole issued bond and share capital of the San Agustin Co., and have repaid the moneys borrowed and used for capital purposes. The partial development of the Tuxpango Fall is now being actively carried out, and it is anticipated that the work, which will be sufficient to provide 17,000 H.P. at the turbines, will be completed in about two years. As the company is incorporated under the laws of Canada, the annual general meetings must be held in the Dominion. The board, however, with the exception of one director, are resident in England. The directors have, therefore, decided that in future a meeting of shareholders shall be held annually in London. This meeting was held in London yesterday.

Prospectus.—*Western Canada Power Co., Ltd.*—The list closed yesterday in an issue of £205,400 5 per cent. first mortgage bonds at £93 per cent. The company has a large demand for hydro-electric power. Contracts have already been signed for over 14,000 H.P. Power was being supplied continuously, at December last, from the plant to Vancouver, New Westminster and Mission. It is expected that the company will have sold the entire present development of 25,000 H.P. before the end of 1912.

Metropolitan Electric Tramways, Ltd.

The directors' report for 1911 states that the revenue, including £31,500, the dividend and bonus receivable upon the company's investment in the North Metropolitan Electric Power Supply Co., amounted to £501,667. After deducting all expenses chargeable to revenue, including an addition of £27,170 to the reconstruction and renewals reserve, and writing down preliminary expenses by £3,000, there is a surplus of £57,855, making, with £2,822 brought forward, an available total of £60,677. Out of this amount of £60,677 there was paid during the year £12,500 dividend for the half-year ended June 30th, 1911, on the preference shares and £9,896 interim dividend at the rate of 2½ per cent. on the ordinary shares, leaving £38,281, which the directors recommend should be appropriated as follows:—To reserve account, £10,000; dividend on the preference shares for the December half-year, £12,500; final dividend on the ordinary shares, at the rate of 3½ per cent. (making a total of 6 per cent. for the year), £13,854; carrying forward £1,927.

In response to the offer contained in the last report of the directors, 4,495 ordinary shares were taken up at par by the shareholders in April last, and have since been paid in full; £8,342 4½ per cent. debenture stock was bought and cancelled last year under the provisions of the trust deed. The premiums paid upon the purchases have been charged direct to profit and loss account. The expenditure on capital account during 1911, including £31,347 on additions to rolling stock, amounted to £45,791. At December 31st last the issued debenture and share capital was:—£571,096 in 4½ per cent. debenture stock, £250,000 in 5 per cent. debenture stock, £500,000 in 5 per cent. cumulative preference shares of £1 each fully paid, £395,832 in ordinary shares of £1 each fully paid, and £314,016 in deferred shares of £1 each fully paid.

The traffic receipts, which amounted to £460,544, show an increase over the previous year of £66,675. Working expenses and payments to local authorities for interest and rent have increased by £42,747 and £16,591 respectively. Thirty new cars were purchased early last year to provide for the increasing requirements of the system, and, in view of the steady expansion of traffic, orders have recently been placed for twenty further cars, to be delivered before the coming summer. Owing to these additions to the rolling stock, the directors have decided to extend the carsheds at Stonebridge Park and Finchley, and to secure a site for a new depôt in the Enfield district. The Metropolitan Electric Tramways Act, 1911, the provisions of which were summarized in the last report, received the Royal Assent in August last. In view of increasing competition from motor omnibuses, the Company has, since the closing of the books, taken a participation in the capital of the Tramways (M.E.T.) Omnibus Company, Limited, which has been formed for the purpose of operating services of up-to-date motor omnibuses, primarily as feeders to, and in connection with, the system worked by the Company. It is anticipated that the new services will be in operation in the course of the coming summer. Reference was made in the last report to the impending purchase by the London County Council of the Company's tramway situated in Seven Sisters Road between the Finsbury Park Terminus and Manor House. With a view to securing a permanent link between the northern portions of the Company's system and the important traffic centre at Finsbury Park, the Company, at the request of the Middlesex County Council, deposited a Bill in the present session of Parliament to sanction the construction of a new tramway running parallel with the tramway to be purchased, but situate in Finsbury Park, and for this purpose to authorise the purchase of a narrow strip of the park where it abuts on the Seven Sisters Road. The Bill has now been withdrawn on the understanding that the London County Council will negotiate with the Company for through running over their respective systems.

The directors of the North Metropolitan Electric Power Supply Co., in which the company hold 30,000 fully paid, and 10,000 £5 paid, ordinary shares of £10 each, have declared a 6 per cent. dividend upon the ordinary shares, together with a bonus at the rate of 6s. per fully-paid share. The business of the Power Supply Co. is increasing satisfactorily, the total number of units sold during 1911 amounted to 26,454,492, an increase of 23·5 per cent. over the preceding year's figures. A supply of energy was commenced in April last under the Southgate Electric Lighting Order, 1904. The North Metropolitan Electrical Power Distribution Co., Ltd., shows satisfactory results from its undertakings at Barnet, Enfield, Hertford and St. Albans, and for the past year has paid a dividend upon its ordinary share capital at the rate of 5 per cent.

	1910.	1911.
Mileage	55·375	56·750
Passengers carried	76,460,980	89,908,677
Car miles run	8,761,837	10,433,113
Average receipts per car-mile	10·78d.	10·59d.
Average receipts per passenger	1·23d.	1·23d.
Cars in stock	262	292

The meeting is called for April 3rd at Electrical Federation Offices, London, W.C.

Continental.—France.—The report of the Société de l'Energie Electrique du Nord de la France for the last financial year shows a profit of £29,889, as compared with £20,107 in the preceding 12 months.

The Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston, of Paris, reports a net profit of £183,326 for the last financial year, as compared with only £155,126 in the preceding 12 months.

Germany. — The balance-sheet of the Deutsche Kabelwerk Gesellschaft, of Berlin, for the last financial year show a net profit of £24,815, as compared with £19,894 in the preceding 12 months. A dividend of 7 per cent. is being declared.

German Electrical Companies.

The *Treuhandbank für die Elektrische Industrie, of Berlin*, which is one of the electrical banks, and is associated with the A.E.G., realised a net income of £11,400 from interest in 1911, on a nominal share capital of £1,250,000, of which one-fourth has been paid. The net receipts from interest in the previous year were £11,900. It is proposed to pay a dividend at the rate of 3½ per cent. for the past year.

The directors of the *Elektrotechnische Fabrik Rheydt, Max Schorch & Co., of Rheydt*, state that the company was well employed in 1911, particularly in the second half, although delays in delivery took place in consequence of a three months' strike. An extension of the works has been carried out in order to largely increase the production. After making provision for depreciation to the extent of £4,000, as compared with £3,400 in 1910, the accounts indicate net profits of £9,800, as against £10,100 in 1910. It is intended to distribute 8 per cent. on the share capital of £87,500, being the same rate as in the preceding year.

The report of the *Kabelwerke Duisburg* states that the turnover in 1911 considerably increased as compared with the preceding year, and all departments were satisfactorily and regularly employed. The buildings destroyed by fire in 1910 were rebuilt simultaneously with an extension in working. The augmentation in the share capital which was decided upon last April had been carried into effect, and the premium of £9,300 realised on the new issue of £37,500 had been placed to the reserve fund. After allocating £23,000 to depreciation, as against £44,000 in 1910, when the fire necessitated a larger provision for this purpose, the accounts show net profits of £23,000, as compared with £9,600. A dividend at the rate of 14 per cent. has been declared on share capital of £75,000, and 7 per cent. on £37,500, as against 10 per cent. on the former capital in 1910. It was mentioned at the recent meeting that the orders on hand at the beginning of the year had experienced a further increase, and the degree of activity had so far been satisfactory.

Rand Mines Power Supply Co.—The Hon. L. W. Bagot, D.S.O., presided at the meeting of this Company held at the end of February. According to a report in the *South African Mining Journal* he said that the accounts showed for the last eight months of the financial year a profit of £32,710 after providing for interest on loan during the revenue-earning period. This was satisfactory in view of the fact that the whole of the period was occupied in starting up huge items of generating plant. Initial difficulties must be expected in starting up a scheme of such magnitude, and minor troubles had to be overcome at Rosherville. Only one difficulty of any importance, was experienced, namely, the failure of certain large transformers, which the engineers said was entirely due to defective workmanship on the electrical windings. This failure had handicapped their operations considerably. There was every reason to believe that all risk of a recurrence would be avoided by the alterations now being carried out. But for the transformer trouble the plant generally had done excellently, especially the compressed air scheme. The erection of the new generating station at Vereeniging was unavoidably delayed pending the issue of a licence to the company under the terms of the Power Act, 1910, which licence was not granted until November, 1910. These works are now well in hand, and unless there should be delay in the delivery of material it is anticipated that the two first turbo-generators in this station will be in service shortly after the middle of 1912. Two additional generating sets of a similar capacity to those at Rosherville are under construction for this station, and this plant will enable the company to meet the increased supply demanded by its consumers.

Evered & Co., Ltd.—The directors report that the trading for the year 1911 has resulted, after the provision of £1,410 for debenture interest and £48 for income-tax, in a net profit of £6,539, which, with £1,320 brought forward, leaves £7,858 to be dealt with. They propose to pay a dividend of 2½ per cent. absorbing £4,269; to write off plant £1,500; and to carry forward £2,090. In considering the disposal of the available balance it should be borne in mind that the buildings have been provided for by the lease redemption policies taken out last year at an annual total premium of £297. A satisfactory increase in the company's turnover during the year under revision has to be recorded, and this increase has, so far, been maintained; but, in view of the serious outlook with regard to labour troubles, a forecast of the future is impossible. All stocks have been valued at the lowest prices generally ruling during 1911, and certain goods which have become obsolete owing to change of fashion have been written off. Machinery, plant, and buildings have been maintained in fully efficient condition. It is intended to subdivide the shares, and the articles of association are to be altered.

Lymington Electric Light Co., Ltd.—Mr. Keppel Pulteney presided over the annual meeting of this company, held on March 20th. The directors in their report stated that the company continues to make satisfactory progress, the total proceeds from the sale of current having been increased from £2,269 to £2,366. The result of the year's trading, including £32 brought forward, shows a profit to the credit of the net revenue account of £1,821, and after paying interest on debentures amounting to £500, there was a balance of £1,321. The directors recommended that £800 be placed to reserve account, and a dividend at the rate of 5 per cent. per annum be paid on the preference shares, amounting to £321, leaving a balance of £200 to be carried forward. The report was adopted.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Thursday, March 28th.—Compania de Electricidad de la Provincia de Buenos Aires, Ltd.—£750,000 5 per cent. first mortgage gold bonds of £20 each, Nos. 1 to 37,500.

Tuesday, April 2nd.—Spanish and General Wireless Trust, Ltd.—249,007 shares of £1 each fully paid, Nos. 1 to 249,007.

Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

British L. M. Ericsson Manufacturing Co., Ltd.—99,990 cumulative 6 per cent. preference shares of £1 each, 10s. paid.

And to allow the following securities to be quoted in the Official List:—

Calcutta Electric Supply Corporation, Ltd.—Further issue of 37,586 5 per cent. cumulative preference shares of £5 each, fully paid (Nos. 160,371 to 197,956).

Pennsylvania Water and Power Co.—Further issue of $100,000 first mortgage sinking fund 5 per cent. gold bonds of $1,000 each (Nos. 7,581 to 7,680).

Potteries Electric Traction Co., Ltd.—The directors report that the total receipts for 1911 were £119,420. The traffic receipts show an increase of £5,598 over the previous highest receipts recorded—viz., in 1907. Up till the end of February this year, the receipts again showed a marked improvement. The working expenses show an increase of £447. After deducting all expenses chargeable to revenue, including £11,704 for debenture and other interest, there remains £35,099, as compared with £26,333. The directors recommend as follows:—Depreciation, reserve account, £2,000; renewals account, £12,000; dividend, 5 per cent. per annum on preference shares, £12,250; dividend at the rate of 3½ per cent. per annum on the ordinary shares, £8,575; carrying forward £681. The depreciation and reserve account will then stand at £19,000, and there will be a credit balance on the renewals account of £10,577. During the year £18,040, as compared with £10,521 in 1910, has been expended on the improvement, renewal, and repair of the permanent way, of which £7,617 has been charged against the year's revenue and £10,423 to the renewals account.

British Aluminium Co., Ltd.—The directors' report for 1911 states (according to the *Times*) that the trading profit, together with interest and dividend on investments and deposits, and the revenue derived from the Kinlochleven and Foyers Estates and transfer fees, amounted to £152,901, which has been dealt with as follows:—Provision for legal expenses, bad and doubtful debts, depreciation of furniture, and proportion of profits payable to directors, £13,407; prior lien debenture interest, £40,000; debenture stock service fund, £43,224; reserve for depreciation, £35,000; carried to reserve account, £17,269; leaving £4,001 to be carried forward. The reserve account to December 31st, including the amount added out of profits for the year, amounted to £50,000. The sum allocated to reserve account in respect of the year to December 31st, 1910, has been invested in securities outside the company's business; and it is the intention similarly to apply the amount allocated out of profits for the year to December 31st, 1911. The output and the sales for the year were larger than in any previous year.

Vera Cruz Electric Light & Power Co.—The directors' report for 1911 states that the net profits in Mexico amount to £27,884, as compared with £24,107 for 1910, an increase of £3,777. After providing for London office expenses, and bond and other interests, there remains, says the *Financial News*, a balance of profit for the year of £13,220, to which should be added the balance brought forward from last year of £10,294, and deducted the transfer to depreciation and general reserve account of £15,000, leaving £8,514, which the directors propose to apply as follows: To dividend on share capital for 1911 at the rate of 2 per cent., £7,000, carrying forward £1,514. The directors have practically settled, on satisfactory terms, a contract with the Puebla Tramway, Light and Power Co. for the supply of a large amount of power from that company's new installation at Tuxpango, which contract will not involve any capital expenditure on the part of this company. This power will, it is hoped, be available in about two years' time. Meantime, the temporary steam plant has been completed, and is now ready for use.

Browett, Lindley & Co., Ltd.—The report, as abstracted in the *Financier*, states that the accounts show a gross profit of £9,924 upon work completed during the year 1911. After deducting £2,101 for bank, debenture and loan interest, and writing off £4,890 for depreciation, there remains a net profit of £2,943 to be deducted from the loss shown in the last balance-sheet. This result is an improvement of £5,106 over the previous year's working. During the year there was a considerable increase in the volume of orders received, but the prices obtained were the lowest on record. The strike of the transport workers in the summer caused considerable disorganisation and delays in the company's works; in addition, the boiler feed-water supply was curtailed by the Manchester Corporation, owing to the exceptionally dry summer. These causes restricted the output over a certain portion of the year, and, owing to getting behind with deliveries, it was necessary, in the latter half of the year, to start overtime and nightshifts, which has increased the cost of production, and consequently reduced profits.

Mexican Light and Power Co., Ltd.—The directors have declared a dividend of 3½ per cent. for the six months to April 30th on the preference shares and a dividend of 1 per cent. for the quarter to March 31st on the ordinary shares.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, March 27th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	3¾d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16 10	..
a Copper Sulphate	,,	£22 15	5/- dec.
a Lead, Nitrate	,,	£25	..
a ,, White Sugar	,,	£25	..
a ,, Peroxide	,,	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (80/82 %)	per ton	£20 5	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£67	£2 inc.
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	½d. inc.
c ,, Tube (brazed)	,,	10½d.	½d. inc.
c ,, ,, (solid drawn)	,,	8½d.	½d. inc.
c ,, Wire, basis	,,	8½d.	½d. inc.
c Copper Tubes (brazed)	,,	11½d.	½d. inc.
c ,, ,, (solid drawn)	,,	10½d.	½d. inc.
g ,, Bars (best selected)	per ton	£84	£4 inc.
g ,, Sheet	,,	£84	£4 inc.
g ,, Rod	,,	£84	£4 inc.
d ,, (Electrolytic) Bars	,,	£71	£2 15 inc.
d ,, ,, Sheets	,,	£88	£3 15 inc.
d ,, ,, Rods	,,	£76	£3 15 inc.
d ,, ,, H.C. Wire	per lb.	9d.	½d. inc.
f Ebonite Rod	,,	5/8	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	..	..
h India-rubber, Para fine	,,	5/0½	2d. inc.
l Iron Pig (Cleveland warrants)	per ton	51/8	1½d. inc.
l ,, Wire, galv. No. 8, P.O. qual.		£14	..
g Lead, English Pig	,,	£16 10	5/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 12 6	5/- inc.
e Mica (in original cases) small	per lb.	6d. to 2s.	..
e ,, ,, ,, medium	,,	2/6 to 4/-	..
e ,, ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10d.	½d. inc.
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£200 to £201	£6 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/4	½d. inc.
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£28 15	£1 dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

All things considered, the markets in the Stock Exchange are by no means bad. The coal strike continues to be the factor of greatest uncertainty, and many people wonder how it is that quotations of domestic issues, such as Home Rails, maintain their prices with the hardihood that they exhibit. The reason, no doubt, lies in the feeling that, after all, the dispute must be settled before long, and that when this happy consummation is reached, markets and prices will go ahead gaily once more.

Central London stocks are the special features of the Home Railway market. The Deferred stock followed up its rise of 17 points last week with another amounting to 9 during the past few days, while the Ordinary capped its jump of 9 with a further advance of 4, and even the Preferred and 4 per cent. Debenture stocks rose 1 each. Various rumours are afloat to account for the boomlet. To some we have already referred; but another one of interesting complexion came into force last week, it being stated that the South-Western, the Great Western, and the Great Eastern were about to guarantee a 4½ per cent. dividend on Central London stocks. Though this was promptly denied, and the prices fell, the latter picked up again readily enough, and the report is merely scotched and not killed. The incursion of the Central London into the Thames Valley district is at any rate held to be a bull point for the company, and the rise, great as it has been, failed to dislodge any particular amount of stock.

City and South London Ordinary rose no less than 4½, Metropolitans jumped up 2, and Districts 1¾, these being the principal changes in the other Undergrounds. The shares of the Underground Electric Railways Company, however, spurted 12s. 6d., and the 6 per cent. Income bonds rose another 5 points upon what was characterised as good buying. In good quarters the price is talked quite confidently to par. On the other hand, Metropolitan Electric Tramways eased off a trifle, and London United Tramways Debenture fell ½, the latter movement being associated with the suggested extension into the Thames Valley of the Central London Railway already mentioned. British Electric Traction issues are weaker. Bath Trams Ordinary rose $\frac{1}{16}$, and the Preference improved to the same extent upon a small amount of buying that came from the West of England.

The new issue of County of London Electric Supply Ordinary shares is pronounced to have been a distinct success. The price at first was about ½ premium, receding later to ¼ premium for the allotment letters, a good many of which came to market. The old Ordinary shares are steady at about 10¾, while the Preference eased off ½. This time there has been little selling of the old shares in order to take up the new, though in the ordinary way this is what usually happens in the case of a new issue. In Cities there is still an excited market, and the price shows a further jump of 25s., making fully £5 rise within a fortnight, after allowing for the dividend deduction. The columns of the financial papers have been filled day by day with much discussion as to what is likely, or not likely, to happen in respect of the City Company. In some quarters the view is put forward that it was not the City Corporation itself which stumbled upon the idea that it would be well to buy out the City Company now; but that, having had this aspect of the case presented to them, the Corporation authorities were attracted by the chance which it afforded them for administering a rap over the knuckles to the London County Council.

Other London shares are firm, with rises at ¼ in St. James' and Metropolitan, and of ⅛ in Kensingtons and South London Ordinary. Some surprise is expressed that Charing Cross shares should have moved so little, because the argument runs that if the City company is taken over by the Corporation, similar treatment might conceivably be meted out to its colleague the Charing Cross, as regards the City part of the company's undertaking.

The Latin-Canadian group is unusually quiet, although this does not mean that prices are any less firm. Indeed, British Columbia Deferred is up 1, and the Preferred put on 3. Mexican Light and Power gained 1, and other Mexican issues have not moved, in spite of most contradictory rumours from the theatre of the revolutionary trouble. Montreal stock at 200 has a rise of 4½ to its credit on the week. River Plate Debenture is 1 higher. La Platas have gone back $\frac{1}{32}$, and United Electric Trams of Monte-Video Debenture rose 1. Calcutta Trams at 6¼ continue their improvement. Madras Ordinary shed ⅛, but Madras Tramways Debenture stock at 97½ is 1 up. Victoria Falls Power Preference shares at 1½ are better on the progress which the company is declared to be making, while a substantial rise in the price of British South Africa shares has also helped the market.

In the Telegraph section the bulk of the excitement has centred round Marconis. The old Ordinary shares have been taken up to nearly 6, the Preference rising 22s. 6d. in sympathy. Canadian Marconis, which made up at 33s. at their special settlement last week, touched 40s. later on, but came back to 36s.; while Spanish Marconis ran up from 1¾ to 2⅛ before reacting. Rumours have been busy with the name of the American Marconi Company, which is said to be on the eve of issue, but which, according to the latest information, is to be postponed for a little while. The market has developed into a wild and highly speculative one, but buyers seem to have the courage of their convictions, and are undaunted by daily rises in the prices of the shares.

In the American group, Anglo Deferred and Preferred have both fallen a little, and Direct United States are also easier, while the two Mackay issues are both lower. West India and Panama shares have sobered down, the price remaining at 4½, while the Second Preference eased off to 10. In the Eastern group, nervousness still remains with regard to the possibilities of the harm that Marconi competition may do to these companies, but Eastern Ordinary managed to regain a point, although Eastern Extensions are ½ lower. A new issue of Reuter's shares is in contemplation, and the price at which they will be offered to shareholders is £11 5s. National Telephone Deferred fell back ½, then went ahead with a smart advance. In other Telephone issues there is no special change, save for a rise of 1 in American Telephone and Telegraph Capital stock.

The Manufacturing division is marked by rises in Callender's Ordinary and Preference, the Ordinary putting on a further 10s. after its rise of a similar amount last week, while the Preference rose $\frac{1}{16}$. Henley's Ordinary, however, are ½ lower. Castner-Kellners eased off $\frac{1}{16}$, and Babcock & Willcox fell ½. There are no other changes of special interest. The price of raw rubber is still on the up grade, but in the share market there is not much notice taken of this, public attention being concentrated too much on other things at the moment for it to pay much heed to the rubber shares. The new Consolidated Diesel Engine prospectus is on the point of issue.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations March 26th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5⅓	5⅓	8⅞ — 9⅛	+ ⅛	5 15 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9⅛	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102	..	4 8 3
Brompton & Kensington, Ord...	5	10	9†	8¾ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8¼	..	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	4⅛ — 4⅜ xd	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8⅞ — 4⅜	..	5 2 10
Do. Do. 4 % Deb... ..	100	4	4	93 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4½ — 5 xd	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	18½ — 20 xd	+ 1½	4 3 2
Do. 6 % Cum. Pref.	10	6	6	14 — 16 xd	+ ½	4 0 0
Do. 5 % Deb.	Stock	5	5	117 —121	..	4 2 8
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	87 — 89	..	5 12 4
County of London, Ord... ..	10	5	6	10½ — 11½ xd	..	5 4 4
Do. 6 % Pref.	10	6	6	11⅛ — 11⅝ xd	— ⅛	5 3 0
Do. 4½ % Deb.	Stock	4½	4½	107 —109	..	4 2 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	101 —104	..	4 6 7
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅞ — 3⅜	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	6	6†	4¼ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 13 9
Hove	5	9	9	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	9	6⅞ — 7¼ xd	+ ⅛	6 4 2
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2½	1⅛ — 2	..	3 15 0
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4†	3⅞ — 4¼	+ ⅛	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98	..	4 11 10
Newcastle-on-Tyne	5	4	4†	3⅞ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum. ..	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	10 — 11	..	5 9 1
Oxford	5	7½	7½	5⅞ — 6⅜ xd	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8⅜ — 8⅝	+ ⅛	5 12 8
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord. ..	5	Nil	2	1⅜ — 1⅝	..	..
South London, Ord.	4	5	5	2⅞ — 3⅛	+ ⅛	5 18 4
Do. 5 % First Mort. Deb. ..	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref...	1	7	7	1 — 1⅛	..	6 4 5
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 —100	..	4 10 0
Urban, Ord...	5	5	..	⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	5	..	2⅜ — 3½	..	..
Do. 4½ % First Mort. Deb...	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord, ...	5	10	10	8½ — 9½	..	5 5 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	5 — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅝	..	5 2 2
Calcutta, Ord.	5	8½	7†	6¾ — 7	..	6 1 5
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½	..	5 5 3
Canadian Gen. El. Com. ..	$100	7	7†	115 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	116 —120	..	5 16 8
Cordoba Lt., Power and T., Ord.	1	3	3†	1 5/32 — 1 5/32	+ 3/32	2 18 3
Do. 5 % Deb.	100	5	..	96 — 99	..	5 1 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92½ — 94½	— ½	5 5 10
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	7/32 — 9/32	— 1/32	Nil
Do. 6 % Pref.	1	6	6	⅜ — ½	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	108 —110	..	4 11 0
Madras, Ord.	5	..	..	2½ — 3	— ⅛	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	...	5	5	84½ — 86½	..	5 15 7
Mexican Lt. & Power, Common	$100	4	4†	85 — 87	+1	4 12 0
Do. 7 % Cum. Pref.	$100	7	7	105 —107	..	6 10 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½ — 96½	..	5 3 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Montreal, Lt., H. and Power ..	$100	7	8	198 —202	+5½	3 19 3
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 8 10
River Plate, Ord.	Stock	10	..	248 —258	..	3 17 6
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	110 —115	..	5 4 4
Do. 5 % Deb. Stock	Do.	5	5	102½—104½	+1	4 15 8
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	101 —103	..	4 7 5
Shawinigan Water, Capital ..	$100	4	5†	133 —135	..	3 14 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	103½—105½	..	4 5 4
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½—101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	..	5 5 10
Victoria Falls Power, Pref. ..	1	Nil	11¾d.	7/8 — 1	+ 1/16	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	104½—106½	..	5 12 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7¼ — 7⅝	..	..
Do. 5 % Deb. Red.	Stock	5	5	97½ — 99½	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	151½ —152½	+1½	5 4 8
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph ..	Stock	3⅜	3	66 — 68	..	4 8 6
Do. 6 % Pref.	Do.	6	6	110 —111	— ½	5 8 1
Do. Def.	Do.	30/-	30/-	25/- — 25½	— ½	5 17 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	100 —102	..	4 18 0
Chili Telephone	5	7	..	7¼ — 7½	..	4 13 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	86 — 88	..	4 10 11
Cuba Telegraph	10	6	6†	9⅜ — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3⅛ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8 — 8½	..	5 17 8
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable ..	10	4½	..	7⅛ — 8	+ ⅛	5 12 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	129 —133	+1	5 5 3
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	80 — 82	—1½	4 5 4
Do. 4 % Mort. Deb.	Do.	4	4	100½—10 ⅛	..	3 18 1
Eastern Extension	10	7	5†	12⅝ — 1 3/32	— ⅛	5 9 10
Do. 4 % Deb.	Stock	4	4	99½—101½	..	3 18 10
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	10	5⅞	6†	10½ — 11	..	5 9 1
Do. 6 % Pref.	10	6	6	12⅝ — 13⅜	+ ⅛	4 9 9
Great Northern Telegraph ..	10	18	5†	32 — 33	..	5 9 1
Indo-European Telegraph ..	25	13	5†	56½ — 58½	..	5 10 2
Mackay Companies Common ..	$100	5	5†	81 — 84 xd	—1	5 13 1
Do. 4 % Cum. Pref.	$100	4	4	70 — 73 xd	—2	5 9 7
Marconi's Wireless Telegraph	1	5	..	5⅝ — 6	+1 3/16	..
Do. 7 % Cum. Partic. Pref.	1	1¾	..	5½ — 5⅝	+1⅛	..
Monte Video Telephone, Ord. ..	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	31/32 — 1 1/32	..	5 10 6
National Telephone, Pref. ..	Stock	6	6†	98⅝ —102½	..	5 17 1
Do. Def.	Do.	6	6†	128½—130½	+3	4 12 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅛ — 10	..	6 0 0
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 5⅜	..	4 15 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102⅜—103⅜	..	4 6 9
Oriental Telep. and Elec. ..	1	8	..	1⅛ — 1⅜	..	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅜	..	4 16 10
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98⅜—100⅜	..	3 19 7
Reuter's	8	5	5†	12 — 19½	+1½	3 5 4
Submarine Cables Trust ..	Cert.	6	6	130 —133	..	4 10 8
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅛ — 7⅜	..	5 8 3
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	2½	1⅛ — 1⅜	..	3 11 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97⅛ — 99½	..	4 0 5
West India and Panama Teleg.	10	1½	1½†	4⅛ — 4⅜	..	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10⅜ — 11½	..	5 6 8
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅜ — 10½	— ⅛	5 17 1
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd. ..	10	7	6†	18⅜ — 18⅝	..	5 2 7
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds.. ..	$1000	4½	4½	102 —105	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 26th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅜ — ⅝	+⅛	Nil
Do. 5 % Pref.	1	5	5	5⅞ — 6	+⅛	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	— 1	..
Do. Do. Deferred	100	..	..	8 — 10	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	..	90½ — 92½	—1	..
Do. 7 % Non-Cum. Pr'f.	100	..	..	36 — 39	—2	..
Do. 5 % Perp. Deb.	100	5	5	96 — 99	..	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	8	8	86 — 88	+4	3 8 2
Do. Pref.	100	4	4	86 — 88	+1	4 10 11
Do. Def.	100	2	2	86 — 88	+9	2 5 5
Do. 4 % Deb.	100	4	4	101 —100	+1	4 0 0
City & South London, Ord.	100	1½	1⅝	42 — 43	+4½	3 15 7
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	102 —104	..	4 16 2
Do. Do. 1901	100	5	5	101 —103	..	4 17 1
Do. Do. 1908	100	5	5	101 —103	..	4 17 1
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	10⅜ — 11⅜	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅜ — 1⅝	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	⅜ — ⅝	..	..
Do. 4½ % Deb.	100	4½	4½	73 — 78	..	5 15 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2⅞	..	4 6 11
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	82 — 84	..	5 19 1
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	3⅛ — 4	— ⅛	..
Do. 4 % Deb.	100	4	4	75 — 78	— ⅛	5 2 7

NAME.	Stock or Share.	Dividends for		Closing Quotations March 26th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Metropolitan Railway Consol.	100	18	17	60½ — 61	+2	3 1 6
Do. Surplus Lands	100	2½	2½	67 — 69	—1	4 8 4
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	38⅛ — 39	+⅜	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3½	4½	89 — 91	..	4 18 11
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5†	5†	37/16 — 3⅝	..	5 13 6
Do. Def.	1	Nil	..	3⅛ — 3⅜	..	Nil
Do. 5 % Pref.	1	5	5	3⅛ — 7/32	—1/32	5 14 3
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	100½ —102½	..	4 17 7
Potteries, Ord.	1	2	..	1/32 — 1/16	..	..
Do. 5 % Pref.	1	5	5	1/32 — 1/16	..	..
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	6 19 8
South Metro. Trams, 6 % Pref.	1	6	..	7/16 — 7/8	..	4 17 10
Do. 4 % Deb.	100	4	4	72 — 77	..	6 17 2
Underground Elec. Railways	10	..	..	3⅜ — 3⅝	+ ⅛	5 4 0
Do. 4½ % Bonds	100	4½	4½	99 —101	..	..
Do. 6 % Income	100	1	1½†	88 — 90	+5	4 9 1
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 1/8	..	..
Do. 6 % Pref.	5	Nil	..	2¼ — 2½	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 84	—1	Nil
						6 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5⅛ — 5⅜	..	5 3 6
Do. 2nd Pref.	5	5	5½	4⅛ — 5⅛	..	5 3 6
Do. 4 % Deb.	100	4	4	9⅜ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	103 —105	— ⅜	4 15 3
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 15 8
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8	8†	9⅜ — 9½	+ ⅛	4 7 8
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	135 —140	+1	5 14 4
Do. Pref. Ord.	100	6	6	121 —125	+3	4 2 9
Do. 5 % Pref.	100	5	5	110 —113	..	4 8 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 —104 xd	..	4 6 7
Calcutta Trams, Ord.	5	6	..	6 — 6¼	+1/16	4 16 0
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅜ — ⅝	..	..
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5⅝	..	4 6 0
Do. 4 % Deb.	100	5	5	101 — 103	..	4 17 3
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	98 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	⅞ — 1	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	56 — 60	..	10 0 0
La Plata Elec. Trms, Ord.	1	..	..	⅜ — ¾	— 1/32	..
Do. Pref.	1	6	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	95 — 97	+1/2	5 1 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96½ — 98½	+1	5 1 6
Manaos Trams & Lt., 1st Deb.	100	5	5	93 — 96	..	5 4 2
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½ —101½	..	4 18 6
Mexico Trams Com.	$100	7	7†	119 —121	..	5 15 8
Do. Gen. Con. 5 % Bonds	..	5	5	96½ — 98½	— ½	5 1 6
Do. 6 % Bonds	100	6	6	100½ —102½	..	5 17 1
Para Elec. Rlys. & Lt., Ord.	5	10	10	6⅜ — 7⅛	..	7 0 4
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	97½ — 99⅝	..	5 0 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅛ — 1⅜	..	1 18 1
Do. 5 % 1st. Deb.	100	5	5	101 —104	..	4 16 2
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5⅛	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	118½ —119½	+ ½	4 3 6
Do. 1st Mort. 5 % Bonds	..	5	5	103 —104	..	4 16 2
Do. 5 % Mort. Bonds	100	5	5	99½ —100½	..	4 19 9
Sao Paulo Tram, Lt. and P.	$100	10	10†	197⅛ —199⅝ xd	..	5 0 3
Do. 5 % 1st Deb.	$500	5	5	104 —106	..	4 14 4
Singapore Trams, 5 % Deb.	100	5	5	81 — 84	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	6	7	5½ — 5⅞	..	6 1 9
Do. 6 % Pref.	5	6	6	5⅜ — 5⅝	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	+1	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	103 —105 xd	..	4 5 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	⅝ — ¾	..	..
Do. 6 % Pref.	1	9	6	9⅜ — 9⅞	..	7 2 2
Babcock & Wilcox	1	26	24†	6⅞ — 6⅞	— ⅛	4 0 0
Do. Pref.	1	6	6	1⅜ — 1⅝	..	3 13 10
B.I. & Helsby Cables	5	10	10†	6⅜ — 7⅛	..	6 17 11
Do. Pref.	5	6	6	5¾ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 13 9
British Westinghouse, Pref.	3	Nil	..	⅜ — ⅝	..	Nil
Do. Deb.	100	4	4	59 — 62	—1	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — ¼	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	54 — 59	..	7 10 6
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	9⅜ — 10⅛	+ ⅛	7 2 10
Do. Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. Deb.	100	4½	4½	98 —100	— ⅛	4 10 0
Castner-Kellner	1	17½	20	3⅛ — 3⅜	—1/16	5 10 4
Do. Deb.	100	4½	4½	105 —109	..	4 10 7
Crompton & Co.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	58 — 63	..	7 7 1
Dick, Kerr	1	5	..	3⅞ — 3¼	..	5 8 1
Do. Pref.	1	6	6	1⅜ — 1⅝	..	5 9 9
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	1/16 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1/16 — 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	⅜ — 1	..	..
Do. Pref.	2	7	7	1⅜ — 1⅞	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7½ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9⅛	..	5 5 3
Do. Deb.	100	4	4	87 — 92	..	4 7 0
Henley's, Ord.	5	15	10†	11⅛ — 12½ xd	— ⅛	6 2 6
Do. Pref.	5	4½	4½	4⅛ — 5⅛	— 1/16	4 6 9
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	9⅜ — 10⅜	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	33 — 35	—1	6 15 2
Do. Deb.	100	4	4	99½ —101½	..	4 9 0
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	⅛ — 1⅛	..	Nil
Do. Deb.	100	4	4	61 — 64	..	6 5 9

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3½ per cent., February 8th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING FEBRUARY, 1912.

The February returns of electrical exports and imports show that the former reached a total of £407,746, or some £60,000 less than in the preceding month, while the imports at £222,714, show a much smaller decrease in value, the January total being £228,245.

The re-exports total of £18,129 for the month was rather under the average obtaining in recent times.

During the month, machinery exports reached over £150,000 in value, while in the cable and telegraph export sections the totals were £67,229 and £56,926 respectively.

The importation of machinery and cables was practically the same in extent as in the previous month, and the decreased import total for the month is traceable to decreased value of telegraphic and telephonic material entering this country.

During the month Japan was our best customer, with India, our Australian Colonies, Argentina, Canada, &c., also well represented. It is interesting to note that the last-named has appeared among the importers into this country during the past two months.

It will be noticed that the German contribution to the imports was rather higher than in January, and that a substantial increase in glow lamp imports is shown.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,038	393	485	15	479	84	4,070	843	760	...	7,655	9,550	25,352
Germany	1,050	38	6	350	538	42	1,390	...	185	...	...	222	3,821
Netherlands, Java and Dutch Indies ...	683	874	102	41	18	21	1,290	100	37	...	50	173	3,389
Belgium	387	557	192	...	334	68	1,309	1,474	4	29	1,401	...	5,755
France	2,263	...	523	...	...	40	6,422	242	6	10	286	17,578	27,370
Portugal	56	42	166	122	...	103	176	...	80	...	54	...	799
Spain, Canary Isles and Spanish N. Africa...	209	...	176	...	19	219	1,320	181	...	...	8	1,097	3,229
Switzerland, Italy and Austria-Hungary ...	392	2,720	34	200	196	38	2,532	...	5	...	155	2,183	8,455
Greece, Bulgaria, Roumania and Turkey ...	245	107	57	58	...	...	536	...	174	...	33	453	1,663
Channel Isles, Gibraltar, Malta and Cyprus...	122	85	117	63	10	126	1,153	23	6	29	...	806	2,540
U.S.A., Philippines and Cuba	247	229	30	550	...	108	747	...	...	...	14	266	2,191
Canada and Newfoundland	682	2,533	111	3,097	80	3,504	11,231	2,193	123	...	30	1,053	24,637
British West Indies, British Honduras and Guiana	342	94	646	84	...	...	755	...	15	10	113	12	2,071
Mexico and Central America	73	163	62	...	...	...	304	...	32	...	...	21	655
Peru, Uruguay and Paraguay	89	...	65	103	195	...	404	...	169	...	7	30	1,062
Chile	1,063	131	136	1,291	25	121	2,398	166	1,649	62	151	123	7,316
Brazil	1,193	941	115	276	90	111	3,543	1,278	115	29	419	1,461	9,571
Argentina	3,491	7,296	533	679	269	999	4,718	5,328	3,993	212	2,649	1,522	31,689
Colombia, Venezuela and Bolivia	...	...	92	72	...	...	1,758	5	...	...	112	...	2,039
Egypt, Persia and N. Africa...	1,700	926	159	82	159	8	2,065	32	91	...	133	1,691	7,046
British West Africa	65	723	41	10	...	42	638	41	18	...	55	138	1,771
Rhodesia, O.R.C. and Transvaal	1,810	1,038	405	2,176	115	249	3,471	...	1,003	129	394	1,062	11,852
Cape of Good Hope	1,247	3,058	230	512	...	391	905	215	156	45	249	153	7,161
Natal	1,558	7,306	785	496	34	...	4,498	2,606	402	...	25	2	17,712
Zanzibar, Brit. E. Africa, Mauritius & Aden	98	21	73	75	...	35	32	...	3	...	79	120	536
Azores, Madeira and Portuguese Africa ...	55	1,152	46	26	...	72	601	...	21	...	18	213	2,204
French African Colonies and Madagascar ...	...	...	...	...	...	...	13	18	...	16	...	...	47
China and Siam	901	847	539	318	156	...	3,028	46	30	211	7	85	6,168
Japan and Korea	1,080	4,720	204	1,451	...	2,892	18,666	4,749	3,258	...	290	12,343	49,653
India	3,843	4,920	2,475	1,330	208	981	14,434	1,995	1,125	646	294	178	32,429
Ceylon	366	307	176	106	108	640	320	36	3	93	100	...	2,255
Straits Settlements and Fed. Malay States...	912	626	270	11	...	10	2,015	94	5	...	69	56	4,068
Hong Kong and Wei Hai Wei	790	144	79	216	...	14	617	75	19	...	36	721	2,711
West Australia	658	230	154	28	28	380	726	...	422	...	779	283	3,688
South Australia	569	1,146	494	243	...	380	1,019	...	...	...	869	160	4,880
Victoria	2,886	6,883	433	1,873	...	88	3,802	212	1,233	...	7,913	50	25,373
New South Wales	5,281	10,746	616	1,110	33	135	9,742	1,174	921	...	1,094	870	31,722
Queensland	277	2,490	59	27	...	272	4,074	4,450	41	...	486	...	12,176
Tasmania	...	704	5	115	...	...	...	...	...	...	...	...	824
New Zealand and Fiji Islands	1,856	3,039	712	524	33	406	10,159	260	214	...	412	2,251	19,866
Total, £	39,577	67,229	11,603	17,730	3,127	12,579	126,881	27,836	16,318	1,521	26,419	56,926	407,746

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	563	35	42	83	...	...	3,531	2,429	450	...	7,195	14,328
Germany	2,651	2,707	2,176	30,160	6,587	1,867	55,385	75	1,040	8,051	30,669	141,368
Holland	...	10	2	3,270	513	...	133	4	...	58	...	3,990
Belgium	481	1,007	26	10	70	165	761	...	367	417	6,457	9,761
France	132	...	983	846	2,232	875	192	1,000	2,154	3,051	908	12,373
Switzerland	1,516	1,156	...	40	...	117	1,461	...	...	29	...	4,319
Italy	...	412	...	...	...	...	1,426	...	...	...	3,237	5,075
Austria-Hungary	...	783	...	899	100	...	75	...	...	330	410	2,597
United States	2,509	50	486	2,578	4,145	461	6,885	10,048	171	369	608	28,310
Canada	102	...	50	...	136	...	...	...	...	...	...	288
Total, £	7,954	6,160	3,765	37,886	13,783	3,485	69,849	13,556	4,182	12,305	49,484	222,409

Additional imports: Spain, carbons, £305.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	7,889	669	...	3,473	304	...	4,879	...	308	607	...	

TOTAL EXPORTS: £407,746. TOTAL RE-EXPORTS: £18,129. TOTAL IMPORTS: £222,714.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

REVIEWS.

Electric Traction for Railway Trains. By E. P. Burch. 1911. London: Hill Publishing Co. Price 21s. net.

From the designation of this volume, one would expect a treatise covering complete engineering details of the electrification of railway trains. The purchaser will, however, in this respect find himself disappointed, for, on perusal of the volume, he will find little reference to purely engineering questions; but as he progresses his disappointment will give way to pleasure at the mass of information collected together and put into a concise form on the operation and financial sides of electrical traction as applied to railway trains. A better title for the volume would perhaps have been "Capital and Operating Costs of Electric Railway Trains."

The early history of the application of electric power to propulsion is gone into in detail in Chapter I, but exception must be taken to the following paragraph under the heading of "Discarded Ideas in Electric Traction":—(1) Long-distance transmission of direct-current power; (2) Control of motor speeds by weakening the field.

With regard to (1) it should be stated that the "Thury" system has not received the consideration it deserves; now, however, a progressive concern in this country controls the system, and is installing it on an extensive railway system abroad. The direct-current high-voltage system is making enormous headway, and at the time of writing it is announced that the Westinghouse Co. will electrify 150 miles of railway with direct current at 1,500 volts for the Piedmont Traction Co.

With regard to (2), the shunting of the fields for high-speed operation, both on the series and parallel positions, is again coming to the fore; in interpole motors no trouble is experienced from bad commutation. Messrs. Siemens give with one of their railway motors an extra running position on the series connections with the field weakened 50 per cent., and two extra running positions on parallel connections, viz., 33 per cent. and 50 per cent. weakened field.

American steam locomotives are described and discussed in Chapter II. There is little doubt that "nosing," caused by the large outside cylinders of these monsters, is very detrimental to the track, causing loosening of spikes and consequent spreading of rails. It is notable, however, that the original New York Central and other electric locomotives have not been altogether free from this defect.

Firebrick arches, which are quite common on English locomotives, seem to be the exception in American. The 2-8-2 Illinois "Mikado" monsters just built are without arches.

Chapter III describes in a very clear way the gains which take place when electric traction is substituted for steam haulage. These gains are not theoretical, but actual, and are borne out by figures supplied by officers of existing electrified lines. There is no doubt that the steam locomotive has reached its limit, and with the heavier trains and higher speeds called for by present-day practice, only one conclusion can be come to—viz., that electric haulage will supersede steam.

Under the heading "Trunk Lines in Freight Service," we are told that expenses per train-mile amount to from 50 to 60 cents, exclusive of fixed charges, office and general expenses, so that on a 100-mile division with 10 trains per day, the yearly train-miles are 3,650,000, and expenses $1,825,000. These figures should read 365,000 train-miles, and expenses $182,500. The saving on the electric locomotive, owing to the power being transmitted to the axles with minimum friction, is, in the case of the locomotive, probably more apparent than real. Take, for instance, the Oerlikon Bernese Alps locomotive; the armature shaft is geared to the jack shaft, the jack shaft driving on to the leading and trailing wheels. Again, the weight of the rods is neutralised by counter-balances, as in the steam locomotive, so that the electric locomotive of this type cannot be said to be very much better as regards track pounding than its rival. It will, no doubt, come as a shock to many who regard electricity as only in its infancy to read that on the New York, New Haven and Hartford Railroad the average mileage per detention is some two or three times better than with steam locomotives, while on the Manhattan Elevated the delays to traffic are 40 per cent. less with electric power than when steam power was used. The New York Central records for 1909 give an average detention of 12 seconds per train, a record unrivalled in the history of railways.

The systems available for electric traction are briefly discussed in Chapter IV. It should be noted, however, that 25-cycle rotary converters are now designed with 1,200 volts across their commutators, so that it is no longer necessary to use two converters in series. Moreover, railway motors are designed for 2,000 volts across their commutators, and tests on the manufacturers' private lines indicate that no trouble should be experienced from this voltage, either to the motors or equipment. As is pointed out, the best system is that which is adapted to the electrification of an entire railway. This question of the system to be adopted is one of vital importance, and therefore the question must be thoroughly investigated by unbiased and level-headed men. The time is drawing nearer and nearer when electrification will have to be seriously considered by all main roads, and as through running is most essential, it is of paramount importance that the system adopted shall be universally applicable to all the railways in the country. The battle of the gauges must not be forgotten.

Chapter 5 deals with the selection of motors for railway service. The advantages and disadvantages of direct-current series-wound, three-phase, and single-phase motors are discussed. It is worth while repeating the words of Dr. Steinmetz in 1908 in the discussion on the electrification of the New York, New Haven Road, viz:—"This, I believe, establishes the single-phase alternating-current motor as one of the pieces of apparatus by which the future electrification of our country's railway system will be accomplished."

In discussing forced draught for the cooling of motors, we are told that the rating is increased by not more than 10 per cent. during the first hour's run; yet the Pennsylvania Railroad motors have a one-hour rating of 215 H.P., but this is raised by means of forced draught to about 250 H.P., which is an increase of 16 per cent. Surely there is something wrong in the figures given for the New Haven freight locomotive motors, where the continuous to the one-hour rating is given as 89 per cent. In speaking of motor suspensions, it is stated that "Nose suspension is the simplest and it has superseded all others," which appears to contradict the statement that "Nose suspension is an unsatisfactory plan." In classifying speed-torque characteristics of motors, the following sentence occurs: "Torque of direct-current motors is proportional to the number of lines of force threading the armature; the number of turns or conductors on the armature; the current in the armature. It is independent of the motor voltage. The lever arm extends through the crank, gear and drivers." The last sentence appears to be somewhat misplaced, as it has nothing whatever to do with the speed-torque characteristics of the motor.

Chapter VI confines itself to motor-car trains; descriptions of practically all trains operating on this system are reviewed, and tables giving the cost per car-mile, weight of trains, &c., are profusely provided. The characteristics of electric locomotives are ably discussed in Chapter VII. Electric locomotives are stated to be simply energy collecting machines; a better name would have been energy-converting machines, as opposed to the steam loco. being an energy-generating machine. Mr. J. J. Hill's words regarding steam locomotives before the Kansas City Commercial Club are worth repeating:—"The men in charge of the railways of this country have struggled for 15 years with the greatest problem of our times—how to move a load whose weight increases 10 per cent. a year with a steam locomotive whose power increases but 2½ per cent. a year. The limit of safe, speedy and reasonable service with existing facilities has been reached." In the table comparing the weight of motive power with the weight of the train for steam and electric trains, the weight of the motive power for a New York Central eight-coach motor train is given as 68·7 per cent. Taking the train as previously given, made up of five motor and three coaches, the motor

coach weighing 53 tons and the ordinary coach 41 tons, the weight of motive power to total weight is about 16·5 per cent., which compares favourably with the figures of 24·5 and 19·5 per cent. for six and eight-coach trains hauled by locomotives. One can quite believe that the energy stored up in the rotating armatures of some of the locomotives requires more powerful brakes, larger brake shoes and tires; take, for instance, the Pennsylvania locomotive. The armatures are 56 in. in diameter, and at 60 M.P.H., the armature runs at 280 R.P.M., and weighs nearly 11,000 lb. If the locomotive makes frequent stops, would not some form of friction clutch be worth considering, more especially in the case of single-phase motors, since, in all probability, the armature would not come to rest if the stop were short, and, consequently, the transformer action, which is a maximum at starting, would be partially eliminated? A description of practically all direct-current locomotives is given in Chapter VIII. The table giving the modifications in the New York Central locomotive design refers to these as being either of the 2-6-2 or the 4-6-4 class. The lithograph, however, shows them to be of the 2-8-2 and 4-8-4 class.

Chapter IX describes all the three-phase locomotives which have been built. These are practically all Swiss or Italian. The only road using three-phase motors in the United States of America is the Great Northern, for the Cascade Tunnel. In the description of the Simplon Tunnel locos. it is stated that the absolute torque is raised by regulating the voltage impressed on the rotor. This should read "on the stator."

Chapter X covers a description of all single-phase locomotives in operation, a large portion of the chapter dealing with the New Haven Road. The reference to the lithograph of the Oranienburg 1906 locomotive gives fig. 196; it should be 156.

The power required for trains is discussed in an elementary way in Chapter XI. The expression for a 1,000-ton train at the summit of a 4,000-ft. grade running down in two hours neglecting friction is given as $8 \times 10^9/550/7{,}200$. This should be $8 \times 10^9/550 \times 7{,}200 = 2{,}000$ H.P. Armstrong's formula for the tractive resistance is given as—

$$\frac{5{\cdot}0}{\sqrt{T}} + {\cdot}03\,V + \left(\frac{{\cdot}002\,AV^2}{T}\right)\left(1 + \frac{N-1}{10}\right).$$

Surely the first term should be $50/\sqrt{T}$, and some limit must be given to the term. The tables giving the average input with varying stops per mile are incomplete, as nothing is given regarding the schedule speed, maximum speed, length of stop, &c. In the example under the heading "Regeneration of Energy," a 1,200-ton train is specified, but only a 1,000-ton train is figured on. It is stated that the Swiss Federal Railway Commission agreed on the basis of a tractive resistance in express service of 11 to 12·4 lb. per 2,000 tons. This should read 2,000 lb.

Chapter XII treats of transmission and contact lines, but only in a very meagre way. This important section deserves more than the space allocated to it. Modification is necessary to the statement that Lord Kelvin's law governs transmissions; in many cases the governing factor is the voltage drop, or, in other words, the I^2R losses are well within the limit imposed by the law, or *vice versâ*. In view of what is stated regarding the third rail and snow in mountain districts, it is noteworthy to remark that during the heavy winter of 1909-1910, the Spokane and Inland Empire 11,000-volt line was the only one in the district which maintained its normal schedule.

Chapter XIII is devoted to power plants for railway train service, and deals with the subject only in a general way. Under the heading of load factor for railway loads, the power factor is spoken of in error. The statement that it is obviously cheaper to transmit the energy from coal by wires than to transport the coal itself on freight cars needs considerable qualification; in fact, generally speaking, the reverse is the case. The cases cited are concerned with peat and lignite fuels of comparatively low calorific value, which is a problem of a different aspect entirely.

The power house operating costs for the Twin City Rapid Transit Co. are given in one table at ·66 cent, and on the opposite page at ·62 cent, a difference of some 6½ per cent.

Chapter XIV details Procedure in Railroad Electrification, and covers such points as essential considerations, cost of electrification, &c., while the volume concludes with a chapter on work done in railroad electrification.

The volume is of American origin, and consequently deals chiefly with American conditions. These conditions differ, in some cases, considerably from those existing in this country; but, at the same time, a careful perusal of the volume will be of great interest to the English engineer in showing the enormous amount of work that has been done on the other side of the Atlantic, and in indicating the energetic way in which the various problems have been attacked and pushed to successful conclusions. The book being American, the new spelling is only to be expected. It is curious to note, however, that what little is gained in space by this spelling is lost several times over by the reiteration and want of conciseness in explanation. The volume abounds in minor errors, which shows great carelessness in the reading of the proofs. The following are a few instances:—Atkinson for Acheson; Manhatten for Manhattan; Odgen for Ogden; derceased for decreased; subrban for suburban; techical for technical; singe for single; whoels for wheels. The name of Mr. Aspinall, of the L. and Y. Railway, is spelt throughout the book as Aspinwall, while Mr. Slichter's name is spelt Slicter. Some of the wording is very lax; for example: "The speed of rotation depends upon the frequency of the cycles of the generator, which is practically constant. When the motor is rotating at maximum speed it is at synchronous speed." In spite of the blemishes mentioned, the volume is certainly one that should be in the hands of all who are interested in electric traction, more especially of those whose duty it is to advise their boards on the commercial and financial side of the problem. The book is well printed in good clear type, and is provided with an excellent index. It contains some 600 pages, and is very heavy, making it very tiring to hold in a convenient position for reading.—S. W.

Electric Smelting of Tin.—The experiments on a large scale in the electric smelting of tin carried out in Cornwall during the past summer by Mr. J. Harden, for the Gröndal Kjellin Co., Ltd., of London, are the complement of the researches of Mr. J. F. Maclaren, initiated in London in 1909, and later of Dr. Walmsley, at the Northampton Institute. Although they used inadequate and extemporised appliances, the results of the experiments of these two gentlemen sufficiently attested the technical and economic feasibility of electric smelting, which has since been abundantly confirmed by Mr. Harden's more extended operations. The novel lines of the blast furnace used have not been divulged; the only detail which has transpired is that it is fitted with three carbon electrodes, 203 × 203 mm. and 1·5 m. in length, with corresponding holders and regulating arrangements. The results of the process are briefly as follows:—The yield of pure tin is with the electric furnace continuous from the beginning; no skilled labour is required, as with the ordinary process; the creation of "hard slag" is avoided, and the output is greater—up to as much, in some cases, as 99·75 per cent. Experiments begun on a small scale, and gradually enlarged, showed that with a purity standard of 96 per cent. of tin the weekly average consumption of energy was about 2,200 KW.-hours, and in single instances only 1,700 KW.-hours, per ton of tin, which might even be lessened, by special arrangements, to 1,400 KW.-hours. The current used was three-phase 50 cycles at 650-670 volts, stepped down to 30, 40, 50 and 60 volts.—*E.T.Z.*

Electrical Method of Cultivation.—A British immigrant to Canada who is taking up a farm at Chatham, Ont., proposes to use electricity for the cultivation of his produce. The electrical system which he is going to put into operation is already producing splendid returns, he says, in the South of England and in France. Briefly, it is to heat the soil by means of underground wires. These, carrying electricity and generating heat, are laid at 5 ft. apart and 1 ft. underground, 25 miles of wire being required for 20 acres of ground. The heat thus diffused is carefully regulated, and its effect is to force an astonishing growth of vegetables and fruit. It is far more effective for forcing, he declares, than the glass-house system, and invariably enables garden produce to be ready for the market from one to three weeks earlier than by any other means, ensuring good prices. The cost of the electric power is small, and in Ontario, in the regions covered by the service of the Hydro-Electric Commission, it is, no doubt, smaller than in most places.—*Glasgow Daily Herald.*

Darwen Electric Lighting.—The L.G.B. has sanctioned the application of the Corporation to borrow money for electrical extensions. The application was for £7,600, but the loan sanctioned is only £6,500.

PROCEEDINGS OF INSTITUTIONS.

Tariffs for Electrical Energy.

By W. W. Lackie, M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers, *at Edinburgh, February 13th; Manchester, February 27th; and London, March 7th,* 1912.)

The accounts of electrical undertakings are frequently adversely criticised by non-technical financial journals which do not acknowledge the principles underlying the maximum-demand system of charging. For this reason I here put forward the accounts of two consumers, A and B, under three differing sets of conditions, viz.:—

1. With an equal number of units used by each.
2. With an equal annual bill paid by each.
3. With an equal maximum demand made by each.

A takes a supply for 200 hours per annum, and B takes a supply for 2,000 hours per annum, the rate of charge being 730 hours' use of the maximum-demand quantity at 3½d. per unit, and all energy in excess of this at ¼d. per unit.

It is clear from the figures here given that to charge A and B the same average rate would be unfair. It is difficult to persuade the consumer who takes energy for less than one hour per day and who pays 3½d. per unit, that he is not being overcharged. He knows that the average rate received by the supply authority is, say, 1½d. per unit, and he imagines that he is taxed to contribute to this result. This, of course, is a fallacy. Were it not for the consumer who gets his power units at 1·7d. per unit, the charge would need to be increased from 3½d. to a much higher figure.

—	Units.	Plant required.	Capital cost.	Amount of account.	Average price.	Interest, sinking fund, and depreciation, at 8 per cent.
		I. Equal Units.				
		h.p.	£	£ s. d.	d.	£ s. d.
A	1,460	10	400	21 5 10	3½	32 0 0
B	1,460	1	40	10 16 8	1·78	3 6 0
		Minimum loss on A			£10 14 2	
		Gain on B			7 10 0	
		II. Equal Bills.				
A	686	10	400	10 0 0	3½	32 0 0
B	1,194	1	40	10 0 0	2·01	3 6 0
		Loss on A			£22 0 0	
		Gain on B			6 14 0	
		III. Equal Maximum Demands				
A	1,500	10	400	21 17 6	3½	32 0 0
B	15,000	10	400	109 12 3	1·75	32 0 0
		Loss on A			£10 2 6	
		Gain on B			77 12 3	

The cost per unit of supplying electrical energy depends—

1. Upon the maximum rate at which the supply is demanded.
2. Upon the number of Board of Trade units taken.
3. Upon the time of day at which the demand is made.
4. Upon whether the supply is taken regularly over the year, or in the winter months only, for a few hours a day, and
5. On the number of consumers being supplied.

The city about which I know most has many huge tenement blocks of offices with load factors of 5 or 6 per cent., but there are also other offices having large basements with a load factor of over 20 per cent. The probability is that the only extra capital expenditure entailed in supplying consumers who take a supply for less than one hour per day is expenditure on plant. The consumer who uses the supply for only 200 hours per annum should not be charged the same rate of depreciation as those who use it for a longer time. Electric lighting undertakings have suffered in the past not so much from plant being depreciated as from plant becoming antiquated. Interest and sinking fund must be charged on the basis of the maximum demand.

If, therefore, those 1-hour consumers are debited with only half the capital expenditure per kw. (*i.e.*, on plant only), and have a reduced rate of depreciation allocated against them, they will not present such a deplorable balance-sheet.

The tabulation annexed to this paper shows the necessity for the maximum-demand system of charging in large cities, and it further shows where a reduction may be made with any surplus. There is no necessity for supplying electrical energy for less than 3d. per unit for lighting in a town or district where the price of gas is 2s. per 1,000 cb. ft. or more, even though such lighting is used only between 7 p.m. and 5 a.m.

Few persons who have looked closely into the subject will say that the maximum-demand system of charging is unsound. Several prominent engineers have stated that it does not take into account the actual time of day when the maximum demand is made. This is not accurate. The amount of plant to be installed to supply any given total number of consumers connected is decreased in proportion to the extent to which the maximum demands of these consumers do not occur at the same time; and this means that the standing charges, represented by interest and depreciation, are reduced; so that the maximum-demand system takes cognisance of the time when the maximum demands occur by reducing the charges to all the consumers. The system is equitable and fair because of this very fact. Any flat rate, or even an approach to a flat rate, must have as its basis the maximum-demand system of charging if it is to be equitable. For instance, against a rate of 3½d. per unit for lighting, a charge of 1½d. per unit for power is fair, because the power supply will be used for at least three times as many hours per day or per annum as the lighting supply is used.

In the table on p. 523 an analysis is given of over 20,000 consumers' accounts. In this an extreme view has been taken, *i.e.*, all charges except coal and carting (for the removal of ashes) have been divided among the consumers in proportion to their maximum demand, and coal and carting have been taken as just under one-fifth of a penny per unit. This was the average cost for 1910 in Glasgow.

This analysis shows that it is necessary to get a revenue of £9 per kw. of maximum demand, including coal and carting. This is made up of £7 17s. per kw. of standing charges, and 0·191d. per unit for coal and carting, the average cost for coal and for carting being £1 3s. per kw. A figure to be noted is that the plant required is stated at 27,475 kw., whereas the maximum load on the station was 23,524 kw., or 16 per cent. less kw. than the summation of the individual maximum demands of the consumers. The difference between these two figures is of course accounted for by the diversity factor amongst the maximum demands of the consumers. Theatres, halls, and schools are seldom lit between the hours of 3.30 and 6 p.m., and the maximum demand in residential districts is an hour later than the industrial or business maximum demand. The opposite extreme to that given in the table annexed is to make the running cost ¾d. per unit, and this would enable the standing charges to be reduced to £4 10s. per kw. In all business premises maximum-demand indicators are erected except where it is known that the supply will not be used for anything like 2 hours per day. In theatres and large works recording ammeters are used to get a fair maximum demand, but in domestic premises the maximum-demand quantity has been arrived at by a maximum-demand indicator or recording ammeter connected in the feeder or main supplying a hundred or more tenement consumers at one time. The maximum demand against domestic consumers given in the analysis, therefore, already allows for a diversity factor. It is also agreed that if the consumers who take their supply for one hour and under were not connected, some of the standing charges, at present allocated against them, would have to be made up by the other consumers. The analysis shows that any of the following rates would give the same financial result:—

Per kw. per annum.	*Per unit.*
£7 17 0	0·191d.
7 8 0	0·250d.
6 0 0	0·500d.
4 10 0	0·750d
3 0 0	1·000d.

Increasing the running charges from 0·19d. to 1·0d. per unit is out of the question, as our total generation, distribution, and management charges were under 0·5d. per unit. It is of interest to note that the actual cost of the additional units shown as an increase over each previous year during the past 10 years is just under 1d. per unit.

As I believe the supply of electrical energy to domestic consumers is of vital importance in all large cities which are at present faced with the smoke problem, and are striving to bring about a purer atmosphere, I should like to draw attention to what has been done in Glasgow to encourage the use of electricity by domestic consumers for purposes other than lighting.

The rates of charge for lighting purposes in Glasgow up till 1901 for business premises and for domestic consumers were 6d. per unit for the first 365 hours' use of the maximum demand, and 1d. per unit for all further quantities. At that date an analysis of the accounts of all our consumers showed that the only class which used the supply for the same length of time throughout the year were the domestic consumers, it being found that they used their supply for fully two hours per day or 730 hours per annum. It therefore became a simple matter to convert the charge of 6d. per unit for the first 365 hours' use, and 1d. thereafter, into a flat rate of 3½d. per unit. This was done. The domestic flat rate has since been lowered to 3d. per unit for lighting.

The return of the accounts now given on the annexed table shows that the domestic consumers use their supply for nearly three hours per day. Since 1901 a large number of smaller houses and tenement flats have been connected to our mains, and such houses have a better load factor than large private residences, for the reason probably that they are unable to take full advantage of the hours of daylight. It is probable also that the average number of hours per day has been increased as the smaller domestic consumer has realised that electric lighting is not prohibitive with regard to cost, and therefore that there is no need for any undue economy in the use of it.

With the problem of black smoke and atmospheric pollution in one's mind, it was incumbent to devise a scheme which would enable the domestic consumer to get a supply of electricity for heating, cooking, &c., at a lower rate, without being put to the expense of separate wiring, with a separate meter, &c. Having ascertained that domestic consumers' premises, similarly situated, and of the same size, were practically consistent from month to month, in the nature and extent of their consumption for lighting, it was a simple matter to devise an adaptation of the maximum-demand system which would meet their case. As their average use of the lighting maximum demand was 800 hours per annum,

and the charge was 3d. per unit, it was suggested that all current consumed over this quantity should be charged at 1d. per unit. In order to enable the consumers to realise that they were getting their extra units at the lower rate, a proportionate number of lighting units was allocated to each of the two-monthly bills, and whatever number of units might be consumed over this minimum in each two months were to be charged at 1d. per unit. The division of the 800 hours' use of the maximum demand over the six periods into which the year is divided was as follows :—

	Hours' use of maximum demand at 3d.
June-July	40
August-September	60
October-November	200
December-January	300
February-March	160
April-May	40
Total	800

All further units at 1d.

The number of hours given corresponds to the hours of darkness from sundown to 10 p.m. each two months, and it was found that the domestic consumers' accounts also gave approximately this result.

The average account of the domestic consumers is shown to be £2 16s. per annum.

In formulating this system of charging, the data allow for the domestic consumers being absent from the city for one or two months per annum. The fact that each two-monthly bill shows its own proportion of 1d. units tends to encourage domestic consumers to use radiators, irons, vacuum-cleaners, &c., without hesitation. This is a case where expediency in charging is preferable to rigid adherence to a fixed principle.

This system of charging for further units at 1d. to domestic consumers has now been in use for one year. Over 500 consumers have installed electrical apparatus of some kind. One hundred of these domestic consumers' accounts, examined at random in different parts of the city, show an increased consumption of 21 per cent. as compared with the corresponding period of the previous year. This represents 7 per cent. increased revenue. If the domestic rate for lighting had simply been reduced, the probability is that the bills examined would have been less, instead of greater, than the corresponding bills for the previous year.

If different persons, in similar houses, have, in a few cases, a different consumption, that is not a sufficient reason for stopping a movement which will simplify the tariff for the general supply. The tariff may make those odd persons, whose bills seem unduly low, light up their premises to a larger extent than they otherwise would have done ; whereas those whose bills seem higher than the average, can either economise or, alternatively, they may be entitled to have their extra units at a lower rate.

It is now admitted that the domestic chimney is mainly responsible for atmospheric pollution. Municipalities must, therefore, as a branch of their activities in connection with the general movement towards public health, recognise the importance of nursing their electrical undertakings by encouraging the use of electrical energy for all domestic purposes. I submit that it would be an enlightened policy on the part of the local authorities and of the nation to encourage the use of electrical energy for domestic purposes by educating the public regarding the possibilities of electrical apparatus, and giving energy at the lowest possible rate. To this end the recently developed policy of taking the surplus revenue from electrical undertakings for the reduction of city rates should be condemned and at once abandoned ; and not only so, but I think electricity supply concerns, both municipal and private, might reasonably ask to be relieved from paying rates, if it could be shown that, to this extent, they were lowering their prices to domestic consumers.

The system of charging now advocated leaves it quite open either to add to or deduct from the number of units chargeable at 3d., if there is any known reason, such as abnormal increase or decrease in the lighting demand. It is not difficult to see from a recording ammeter chart what energy is used for lighting and what energy is used for "other purposes." This method has been adopted in fixing the lighting demand in the larger houses ; it has also been used to ascertain the maximum demand in engineering works, where the consumer, having previously generated his own current, has not the wiring for lighting and for power on separate circuits.

Date of period.	1 R & K.		2 R & K.		3 R & K.		4 R & K.		5 R & K.		6 R & K.	
	U.	s. d.	U.	s. d.	U.	s. d.	U.	s. d.	U.	s. d.	U.	s. d.
June-July ..	2	0 6	4	1 0	6	1 6	10	2 6	12	3 0	13	3 3
Aug.-Sept. ..	4	1 0	6	1 6	10	2 6	15	3 9	17	4 3	20	5 0
Oct.-Nov. ..	13	3 3	18	4 6	30	7 6	50	12 6	57	14 3	65	16 3
Dec.-Jan. ..	19	4 9	24	6 0	44	11 0	75	18 9	86	21 6	97	24 7
Feb.-March ..	10	2 6	14	3 6	24	6 0	40	10 0	46	11 6	52	13 0
April-May ..	2	0 6	4	1 0	6	1 6	10	2 6	12	3 0	13	3 3
	50	12 6	70	17 6	120	30 0	200	50 0	230	57 6	260	65 0

R = room. K = kitchen. U = units.

It is easy to see from a recording ammeter chart, even in the winter months, what the lighting demand is, and this can be confirmed by comparing the winter chart with the summer chart. The rate of charge or maximum-demand quantity has been increased proportionately to make up for the lighting demand, and all energy is charged at power rates, or a fixed annual sum is charged to cover the difference between lighting and power rates.

To abide rigorously by the Hopkinson method, which means charging, say, £5 per KW. plus ½d. per unit, has disadvantages. It was tried in Glasgow and consumers objected to it. Their bills were very much the same the whole year through, and we had serious complaints from people who got in a bill for electricity either when their house was shut up or when they were not consuming any current. The objections now stated to the Hopkinson system and other systems which are based on dividing the standing charges equally over the year, do not apply to power consumers' accounts, as their consumption is, as a rule, regular and consistent from month to month.

As already indicated, each two-monthly period is allowed to stand by itself ; and if a domestic consumer is absent from his house during the whole of any one two-monthly period, he is not asked to make up the units allocated against that period. On the average, the quantities payable at 3d. per unit for the different houses are shown in the accompanying table (above).

The following table gives the cost of generation, distribution, &c., during 1910-11 ; the capital outlay involved and return thereon, by different classes of consumers, based upon the units sold :—

Class of consumer.	Number of meters.	Units consumed as recorded by meter.	Price per unit.	Average price received per unit in pence.	Average use per day of max. demand in hours.	Amount of plant required in KW.	Standing charges on proportion of plant ex. depn. per unit in pence.	Total cost including depn. per unit in pence.	Profit or loss per unit in pence.	Capital outlay.	Gross return per cent. on capital outlay.	Net profit or loss per cent. on capital outlay.
1 hour and under ...	3,716	778,538	3½d.	3·500	·566	4,297	8·316	10·649	−7·149	£294,548	3·854	−7·874
1 hour and under 2 hours	2,962	2,504,041	3½d. and ¾d.	3·497	1·495	4,735	2·845	3·774	− ·277	324,572	11·244	− ·888
2 hours and under 3 hours	1,661	2,187,929	Do.	3·002	2·442	2,339	1·611	2·217	+ ·785	160,332	17·073	+4·468
3 „ „ 4 „	791	1,476,868	Do.	2·335	3·468	1,194	1·218	1·723	+ ·612	81,846	17·552	+4·596
4 „ „ 5 „	348	1,203,799	Do.	1·975	4·486	734	·919	1·346	+ ·629	50,314	19·689	+6·265
5 hours and over ...	396	2,484,040	Do.	1·571	6·676	1,042	·632	·986	+ ·585	71,426	22·767	+8·480
Domestic	6,548	1,466,381	3d.	2·995	2·784	1,443	1·483	2·056	+ ·939	98,914	18·500	+5·801
Churches	347	191,082	3d.	2·991	1·272	456	3·596	4·712	−1·721	31,258	7·618	− ·438
Theatres, halls, & schools	308	1,246,228	3½d. and ¾d.	2·579	1·724	2,132	2·573	3·432	− ·853	146,143	9·162	−3·035
Power and heating ...	3,519	23,809,939	1½d. to ¾d. ; 1d.	·888	8·299	7,860	·497	·816	+ ·072	538,783	16·358	+1·320
Special agreements ...	124	1,714,695	1½d.	1·512	5·274	876	·770	1·159	+ ·353	60,047	17·987	+4·195
Total meter consumption	20,720	39,063,540	—	1·528	4·068	27,108	1·046	1·506	− ·195 + ·218	£1,858,183	13·387	−1·716 +1·909

Cost of coal and carting in each case = ·191d. per unit.

Discussion at Manchester.

Mr. S. J. Watson said that the large number of tariffs in use up and down the country was extraordinary. This condition of affairs was not good for the industry, and there should be some attempt to reduce the tariffs to a common basis which would be clearly understood by everybody who used an electrical supply. The figures which the author gave showed the enormous differences which existed in the charge per unit to different classes of consumers. Taking the one-hour and under consumers, the average amount charged per KW. was about £2 3s., whilst for five hours the average amount charged exceeded £16 per KW. Obviously there was an enormous loss on one or an enormous gain on the other. The author stated that the average account of domestic consumers was £2 16s. per annum. The question of domestic supplies was one of the most important, and he doubted whether with such a small income per service the supply could be profitably given, not on account of the generating costs but on account of the distributing cost including capital charges on mains, repairs, meter reading, and accounts. They should do their utmost to encourage the domestic use of sundry apparatus to increase the revenue per service from small users. The existing systems of charging on flat rates per unit made it difficult to give reductions by comparatively small increments. At

present if it was desired to reduce from 3d. per unit, it was necessary to jump to 2¾d. or 2½d., which was equal to 9 per cent. or 17 per cent. If the flat rates were maintained, he would suggest that the rate should be 10 units for 2s. 6d., and the reduction could then be made in penny stages.

Mr. Miles Walker could not understand why to-day, within 10 miles of Manchester, they should be paying 6d. per unit. Perhaps if they lived in Glasgow, they would be paying 3d. and 1d. per unit after so many years. He thought that where large power users were considered, a good deal of difference should be made in the charges for good and bad power factors. When a consumer could see that by using a better power factor he would be charged a better rate, they would get better power factors.

Mr. Alderman Walker said one of the principal objects to be borne in mind in obtaining an increased use of domestic apparatus was that no separate wiring should be required. In trying to get lighting consumers now on the Manchester system to install radiators, &c., immediately they were told that it was necessary to incur extra capital expenditure, they would not listen any further and refused to adopt electric aids in their domestic economy, yet they were the type of consumer who would be the most advantageous to the department if they could be obtained.

Mr. Cooper said the author had stated there was no necessity for additional wiring for radiators. That might be so if the installations were originally wired for carbon lamps. Mr. Watson mentioned the difficulty of reducing the price of electricity by even ½d. as being too big a jump. He thought the best plan would be to work by a system of discounts, say, 2½, 5, or 10 per cent. for prompt payment and at the same time get the money in sooner.

Mr. C. C. Aitchison agreed that the question of power factor was a serious one for station engineers. Double wiring was a thing to get rid of if it could possibly be done, but it was very necessary to see that additional load by the connection of radiators, &c., was not growing out of all proportion to the original wiring. He agreed with the suggestion Mr. Watson made with regard to charging in larger units. He did not agree with discounts based on the number of units consumed; discounts on the amount of the bill were better. He would be pleased to see all his consumers gradually adopt the flat rate.

Mr. H. T. Wilkinson thought the author had done quite right in devising so simple a tariff. He had often wondered why, in the case of flats, blocks of small houses, offices, &c., a flickering device should not be installed in each consumers' premises, and a charge made on the demand at which the flicker operated without any unit charge; it would practically amount to a rate such as was charged for water. This system would considerably reduce the capital cost, first, by keeping down the maximum demand on the station, and secondly, in the consumers' premises by eliminating the meter, except one for the whole building. It would also reduce the running expenses in reading meters and maintaining them, which Mr. Lackie mentioned amounted to 12½ per cent. of the cost of supply to the domestic consumer. They would also get a very good load factor and save work in the accounts department, as the accounts could be made out for some time ahead quite accurately, instead of there being a rush at the end of each quarter. The scheme would not be feasible where heating and cooking apparatus was installed, and separate circuits would have to be provided. In the case of large power users it was a question of getting the best price they could. He had known cases where consumers had been charged quite in their own language as it were—such as a weaving shed at so much per loom per annum. In a certain case where a consumer had ridiculed the price of 0·9d. per unit, a much better price was obtained by an annual charge based on the horse-power hours which he was firmly convinced would be consumed on suction gas at 0·1d. each.

Mr. W. Cramp said there was the question of limit of supply area. It seemed rather unfair that a consumer who was 5 miles from a centre of supply should get a rate like that of the man in the centre of the city. In Mr. Lackie's table special agreements were mentioned for a consumption of 1,714,693 units at 1½d. per unit. It was quite clear from this that the large consumer was not in Glasgow encouraged to the same extent as in some municipalities. When both electricity and gas were obtainable at reasonable prices for domestic purposes, the amount of smoke in the neighbourhood would be much reduced, and it was high time that Manchester made a move in this direction. Mr. Lackie had apparently discovered the constancy of load factor for domestic purposes; it was on this that his tariff was based. He agreed entirely that separate wiring for power and light must be abandoned.

Mr. Lackie, in the course of his reply, said that while it was true that certain consumers gave a return of only £2 16s. per KW., and others paid £12 per KW. The consumer who paid £12 and got his energy at 1½d. per unit, did not complain of excessive rates; it was the consumer who gave the smaller return, and was charged at 3½d. per unit, who found fault with their methods of charging. Alternatively to reducing the rate per unit from 3½d. to 3¼d., or charging a rate per 10 units, they might reduce the number of hours' use from 730 hours' use at 3½d. to some such figure as 700 or 600. It was quite true that the consumer having a bad power factor should pay a higher rate per unit, but if it was difficult to explain the meaning of the load factor to the ordinary customer, it would be far more difficult to acquaint him with the significance of the power factor. The Glasgow Corporation had never taken profits from the Electricity Department for the relief of the rates. It was obviously impossible to have a fixed price for electrical energy all over the country when one found coal varying in price from 4s. to 24s. per ton, interest varying from 2¾ to 4 per cent., and sinking fund from 1 to 3¼ per cent. He doubted whether even a fixed principle could be laid down, owing to the varying nature of the supply in different districts and the varying diversity factor in the case of different classes of consumers. With reference to special agreements, the analysis given in the paper showed that it was immaterial whether a consumer paid for 730 hours' use at 3½d., and all further units at ¾d., or merely paid the flat rate of 1½d. quoted.

Discussion in London.

In opening this meeting, the President mentioned that this paper and the preceding one on the subject of electricity tariffs were part of a scheme being carried out by the Institution to promote the much wider adoption of electricity for domestic purposes. [As our London readers are aware, an informal meeting was held on the 22nd inst. to discuss the matter generally.]

Mr. A. K. Scott Moncrieff said that theory was not such a certain support as fact in such a matter as that dealt with in the paper; he thought that a graphic chart of the station loads, comparable with the tabulated matter in the paper, would show more clearly their relative values. Diversity factor was an important feature, and it was not so useful as regards the mains as it was on the generating plant; he (the speaker) could not agree with the reduction of 16 per cent. on the maximum demand to meet the 16 per cent. diversity factor of the total load, since the long-hour consumer contributed little to diversity factor. It was interesting to note that at Portsmouth the load factor had remained almost constant during the last ten years—about 14 per cent.—yet the total costs had dropped from 2·1d. to 1·4d. per unit, and the output had increased to four times as much. The maximum demand had to be paid for, but with diversity factor one got something for nothing.

Mr. E. T. Ruthven Murray said that it seemed that by the author's tariff, although there was a balance to the good on the whole, there was a loss on 7,000 consumers out of a total of 21,000. He questioned whether the tariff was so simple as was suggested; how did the author arrive at the maximum demand of the smaller consumers and proportion of 3d. units? It appeared that recording ammeters were used to get the demands of some consumers, while some consumers' demands were estimated after inspection. The latter method was apt to be unreliable. In considering the factors bearing on the cost of supply, the size of the consumer was a very important feature which influenced the cost of supplying him individually. He had found that the cost of reading and inspecting meters, and rendering accounts amounted in many cases to 24s. per consumer, or even higher, and it was obvious that this would not pay in the case of a small consumer. These "consumer" costs could not fairly be averaged over a number of consumers; the small man must be charged more than the large one, and it seemed that a graded scale based on this must be the only fair arrangement.

Mr. A. H. Seabrook said it was practically impossible to charge the small consumer what it cost to supply him. The author's scheme was somewhat indefinite, but it was satisfactory if it brought business. He did not see how one could go to a prospective consumer with the author's tariff without assessing the maximum demand, and it would be interesting to know how that was done.

Mr. L. E. Buckell asked how the author arrived at the demand for each individual consumer; if by means of the demand indicator, the capital cost would be increased; if by assessment it would be interesting to know how it was done. The question of mains was very important; load factor only concerned the station and did not affect mains, office expenses, &c.; the amount of revenue was quite as important as the load factor, and it was an ordinary commercial factor which controlled the supply of electricity as of other things. In Newcastle they considered that they had got from 10 to 15 per cent. of the possible domestic load, and this showed the large margin for extended business. Maintenance of the meter was usually covered by the meter rent.

Mr. A. J. Cridge said the profit on the domestic consumer was out of all proportion high as compared with the power consumer.

The cost of meter reading ran out at about 9d. or 10d. a day, and there was a good margin left to make up the 7s. mentioned by the author.

Mr. W. E. Burnand (partly communicated) said that he felt strongly that unsuitable tariffs and restrictions were at the present time holding back the industry from a great expansion. The great fault was that they did not sufficiently coincide with the cost of production. He agreed that the principle outlined by Mr. Arthur Wright was the correct one, but he did not see how a much more incorrect system could have been developed than that employing maximum-demand indicators on consumers' premises and basing the high-rate charge on monthly readings of these indicators. The broad objection to it was, that for every unprofitable unit that was choked off, probably a hundred or more profitable ones were choked off, in addition to the difficulties of getting customers to appreciate a system usually not understood by the suppliers. A chart based on data placed at his disposal by Mr. Fedden, showed what load had been carried by a large generating system supplying an industrial town (Sheffield), and the total length of time the load had been above or below any given value during the year. This showed in a striking manner the large proportion of time during which much of the plant was standing, and the serious handicap of having to carry a lot of spare plant as a sort of insurance against trouble with extraordinary peaks that occurred only once or twice a year, with a margin for a specially long, heavy fog, that might or might not occur at all. The curve represented the output over quite a normal year (1911-12). Over 95 per cent. of the revenue-producing load lay below the point marked x, and if they

could have been sure that the load would not exceed this, the plant need not have been extended beyond the line N. All the plant indicated by the distance N to C was needed to cope with the almost insignificant (as regards revenue) part of the curve above X. In view of this, it was quite evident that the top part of the curve was of no use to the producer, and it appeared doubtful whether this would pay at even 10s. a unit. Control must be obtained over this peak, so that it would be avoided, if the supply was to be cheap. The greater part of the normal peaks lay below the point X, and this showed where the demand indicator system failed badly. It might reduce the curve above X, but this did not compensate for the reduction below this point, and the extra peak was not due to half the consumers having doubled their maximum demand, but was the result rather of normal maximum demands abnormally overlapping, which the indicators took no account of. Additional load at any point of the curve below X, even peak load, was almost equally profitable, provided it did not increase the load above X. The whole of the output below X could be equitably dealt with by means of a fixed charge based on the actual fixed costs of the service, plus a low rate per unit. The fixed charge should be practically equal to the net cost to the suppliers, and the profit should come on the rate per unit. The part of the curve above X should, in his opinion, be done away

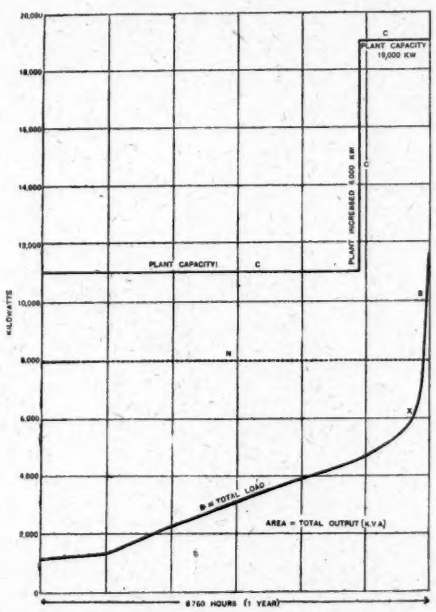


Diagram showing the Relation of Station Load and Time at Sheffield.

with by bringing this under the control of the suppliers, and he thought the way to do this was when the load approached a fixed ratio of load to plant capacity, say 25 per cent. of plant capacity N, to put an extra 3d. to 5d. per unit on all load, and let the consumers know it was on. This left it open to the customer to leave on any vital load, whilst taking off load that could be readily spared for the hour needed to get over the abnormal hump, thus having the effect of keeping this down with the minimum of inconvenience, not comparable with the reduction in cost made available by this arrangement. An additional dial might be added to existing meters to register the additional high rate charge, this dial being made to register only at and above a fixed ratio of total load to plant capacity. The best method to adopt to work this indicator and mechanism remained to be proved, but it was quite certain that it could be done. This system was the only one that restricted the use of current at the time when required, and encouraged full use at all other times, thus combining lowest costs with maximum convenience to both users and suppliers. The bills rendered under this system would be very simple, comprising a fixed charge and units at low rate, and occasionally units at high rate. This system was obviously applicable to all classes of service.

Mr. J. F. C. Snell, from an analysis of the tabulated results, concluded that the one-hour consumer should be charged at a higher rate. Many supply undertakings were beginning to feel the effects of cooking and heating appliances. He had himself made some heating tests and found that, at 2d. per unit, there was a saving over the use of gas. Given energetic pushing of domestic electricity, he believed there would be great developments in that line and that the tariff would take care of itself, everything tending to bring the cost of supply lower. There was a great lack of information as to individual loads, which must be analysed and understood before the tariff question could be settled.

Mr. W. A. Chamen referred to the supply conditions in South Wales, where, owing to the Eight Hours Act, the power load came on at 6 a.m., and fell away at 2 or 3 p.m., with a peak at 10 or 11 a.m., the conditions being inverse to those in large towns. There was scope for electric lighting in many villages where oil lamps were now used, but the difficulty was the wiring, which his company were now undertaking. They used overhead mains, and the street lighting was controlled by clock meters, and it seemed possible that "collier" consumers could be supplied through the same switches and cut off during the day. The idea was to charge, say 1s. a week all the year round and collect the revenue in advance giving a ticket (similar to a tramway ticket) as receipt. The disadvantage of this was that it did not provide for day use of electricity, and he was undecided, for that reason, as to its adoption.

Mr. Arthur Wright mentioned the life of the concession as an important factor in the cost of supply in the case of companies. This particularly applied in London, and until some definite knowledge of the course of events in 1931 were obtained, we could not expect low rates for lighting. The size of the generating plant was another factor of importance; with modern plant additions costs of supply were decreasing, and it seemed that any consumer whom it actually did not cost more to supply than the amount of his bill, was worth keeping. He was not an absolute loss. Events might lead to a great decrease in cost of production in a few years, and it was inadvisable to drive the present-day unproductive consumer away in view of that.

Mr. Mordey questioned whether there was such a loss as appeared from the supply to churches, theatres, &c., as people who attended those places cut down their lighting at home, and merely transferred their load.

Mr. W. W. Lackie, in reply, said that an analysis of Edinburgh consumers showed agreement with the figures he had prepared for Glasgow. To assess the consumer's maximum demand the simplest way was to take the last year's consumption and divide it by 800, or a demand indicator could be installed. At Glasgow there were a number of flats where five or six floors were served by one service, which reduced the cost of the latter. Actually the average number of consumers per service over the whole city was 3·3, while in the residential parts it was 7. The new consumer was assessed like similar consumers in the same district. Since the system had been introduced in Glasgow, some 900 electrical appliances had been connected.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Meldelp" writes:—"Is it necessary for me, as engineer for the above company, without any powers, to make any return to the Board of Trade? It is a private company, and the supply is not solely for the town. We use the power for our own factories as well, and we have not any competition."

"J. J. C. S. B. N." writes:—"I shall feel extremely obliged if you will place the following query in your 'Legal Query Column':—Is it necessary for a private limited liability company, supplying electricity for lighting and power purposes, to make any return to the Board of Trade? The objects of the company are not primarily the supply of electricity."

* * These two queries may be conveniently answered together. There is nothing in any Act of Parliament relating to the supply of electricity which places any liability of this kind upon a person who is privately supplying electricity on his own account. Indeed, he is subject to no interference at the hands of any Government department unless he runs wires "in, over, along, across or under any street" (having regard to the objects of the company). Nor can he be interfered with in any way by any local authority by virtue of Sec. 23 of the Electric Lighting and Power Act, 1909.

The Largest Turbines in the World.—The Commonwealth Edison Co., Chicago, which is probably the most important electric supply authority in the world, has decided to carry out some further extensions in connection with its Fisk Street station. This station at present contains 10 turbo-generators of 14,000 KW. each. The proposed extensions will consist of four turbo units of 25,000 KW. maximum continuous load and 20,000 KW. economical load. The order for the first machine has been placed with Messrs. C. A. Parsons & Co., and it will be built at their works at Heaton-on-Tyne. The machine will generate three-phase current at 25 cycles and 9,000 volts, and will run at 750 R.P.M. In accordance with Messrs. Merz & McLellan's recent practice in ordering turbines of the reaction type, the turbine will be of the two-cylinder type, the high-pressure cylinder being a single-flow turbine and the low-pressure cylinder being a double-flow turbine; the high-pressure cylinder body will be of steel. The exciter will be direct-coupled to the end of the alternator shaft. The alternator will actually generate current at 4,500 volts, the current being stepped up to double this pressure by an auto-transformer to be supplied by the General Electric Co. in America. The specified steam conditions are 200 lb. steam pressure, 200° F. superheat, 29 in. vacuum. We shall hope at a later stage to be able to give some particulars of the consumption of this machine. The Commonwealth Co.'s extensions and the design of these turbo-generators are being carried out by Messrs. Sergeant & Lundy, the engineers of the company, in conjunction with Messrs. Merz & McLellan, of Westminster.

NOTES ON CLEANING BABCOCK AND WILCOX BOILERS.

By JOHN S. LEESE.

Although Babcock and Wilcox water-tube boilers are very widely used in this country, it is probable that there are still many engineers whose experience with them is not of sufficiently long duration to preclude the possibility of some slight instruction being obtained from the following practical notes on cleaning this type of boiler, with which the writer has had an extensive practical acquaintance.

When a boiler is layed off for cleaning, the first operation which should be carried out is that of clearing out the grates, ash pit and combustion chamber, at the same time removing the soot and dust from the caps and tubes. This may be partially accomplished when the boiler is still under steam by the use of a suitable steam jet through the opening in the side of the brickwork setting, but it will not be found possible to clean all the soot off thoroughly by this means. As soon, therefore, as the boiler has cooled off enough, the operator should enter each compartment and push his steam jet down between the rows of tubes, when, if he uses an ell piece on the end of the jet pipe, he will be able to make a clean job of all the caps and tubes and scour all the dust and soot from the corners and crevices also. Whilst the operator is inside the setting he should make a careful examination of the brickwork, firebrick lining, baffles, dampers, grates, &c., making notes of all such repairs as may be necessary.

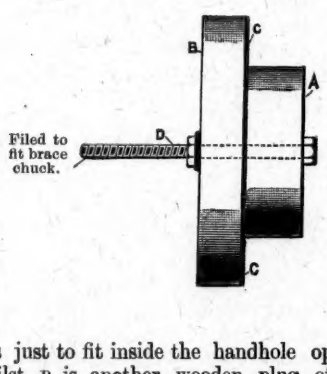
To clean the internal parts of the boiler itself the first step is to open the blow-off until the water has fallen away from the upper drums. The manholes on these may then be removed and the inside of the drum flushed out with a hose-pipe, using the best pressure of water available. The drums may then be entered and examined for pitting, scale, and oil. All scale and oily deposits must be carefully scraped and cleaned off, after which it will be found beneficial to paint any places which appear to have been subject to pitting and corrosion with a coat of white lead. If there is no particular hurry about getting the boiler into commission again, it will also pay to give the internal surface of the drum a light coating of paint up to a point a little above the normal water line.

The blow-off cock may now be opened again and the water completely drained off from the boiler. The tube hand-hole caps may next be removed from both headers, and should be placed, together with their nuts and bolts, in a receptacle containing water, in order that any scale which may be upon them will not become hard, and thus hinder its easy removal. Some sorts of scale will be more readily removed if a little paraffin is placed in the water as well.

The tubes may next be cleaned internally, and this process should be started before the tubes have had time to drain dry. It is a long and very tedious job to tackle the tubes with a hand cleaner, and a turbine or other form of mechanical cleaner should always be found in a plant where Babcock & Wilcox boilers are installed. The cuts which it is permissible to take with a turbine cleaner naturally depend upon the thickness and character of the scale. For scale $\frac{1}{4}$ in thick, for instance, two sets of cutters should be used, but for $\frac{1}{8}$ or $\frac{1}{16}$ in. of scale it will be only necessary to use the finishing cutter unless the scale is of an exceptionally hard variety. Great care should be taken not to stop the feed of the cutter through the tube, but if for any reason such stoppage is unavoidable the turbine must be stopped at once or else damage to the tube is likely to occur. The time taken to clean a tube also depends upon the thickness and hardness of the scale. The cutter should be kept well up against its work, but should not be heavily fed into the scale. A little practice will soon teach the operator how to handle the mechanical cleaner. If there is no means by which the water can be carried away from the rear header, the tube caps will have to be left on at this end whilst the cleaning is in progress, and in this case care must be exercised so that the turbine is not fed clear through the tubes and on to the rear head caps so as to damage the latter.

The probability is that the plant—unless it be a large one—will only boast one mechanical cleaner, so that whilst the senior operator is scaling the tubes, the rest of the help can go ahead with the caps, bolts and nuts. These must be completely cleaned of scale and carefully dried, when the faces and backs of the caps will require polishing, as also will the faces of the nuts. No. 1 emery cloth mounted on a wooden disc which, in turn, is secured to a wooden belt pulley and is rotated at about 800 revolutions per minute, will be found to be an excellent polishing medium. The caps and nuts must be held quite square against the emery cloth in polishing in order to avoid leaky joints after the caps are re-assembled. Each polished surface should be wiped with a greasy rag after it has been thus ground, in order to protect it against the insidious inroads of oxidisation. The nuts should be run up the bolts with a mixture of graphite and boiled linseed oil, or graphite alone, but an excess of either is undesirable. Graphite is the easiest to apply, it being lightly brushed on to the bolt threads.

When the tubes have been scaled the header surfaces must be polished around the handholes and a useful device for accomplishing this may be made as shown in the accompanying sketch. A is a circular wooden plug of such a



diameter as just to fit inside the handhole openings in the header, whilst B is another wooden plug of about 2 in. larger diameter. C is a piece of No. 1 emery cloth, which is placed against the plug B, and is clamped between the two plugs by means of the central bolt D, a nut and washer being run up the bolt behind the disk B, as shown. The end of the bolt is filed up to fit the chuck of a carpenter's brace, by means of which the emery may be rotated, and at the same time pressed hard up against the surface which it is desired to polish, the plug A acting as a guide in the handhole opening. The latter will be cleaned and polished by a few revolutions of the brace.

The cleaning process is now finished, and the re-assembling of the caps may be commenced. This part of the job requires the utmost cleanliness, and the application of a mixture of boiled linseed oil and graphite to the polished and ground surfaces of the caps and nuts should not be omitted on any account. Every possible precaution should be taken to eliminate the presence of the slightest trace of grit or dirt on the polished surfaces of the handholes or caps. One single speck of emery remaining upon the surface of a cap will unfailingly be the cause of a leakage, which, although in itself it may not be of any account, will engender the corrosion of the header and cap to a greater or less extent, so that the grinding-in process for that cap at the next cleaning will be an extremely tedious undertaking. The tightening up of the nuts should be very carefully undertaken. The application of too much strength will easily fracture the claws, and in using the wrench it should be remembered that the joint which is being operated upon is a metal to metal one, and that there is no soft packing to pull against.

When all the caps and manhole plates are again in position the boiler should be filled with water and any leaks marked with chalk for attention. If none of the leaks are excessive, the water pressure should be pumped up to between 50 and 100 lb. per sq. in., when any additional leak must be marked. Next relieve the pressure, slacken back the nut of any leaking cap slightly—that is to say, not enough to loosen the cap, but enough to allow of giving it a slight twist. Then tap the cap back and forth sideways with a hammer, giving it a slight twisting grinding movement, and tighten thenut up again. In the great majority of cases this attention

will make the joint tight, and will avoid emptying all the water out of the boiler again. If, however, the cap still leaks, the water should be emptied out and the cap properly attended to and corrected, irrespective of the language of the assistants.

The use of compounds in Babcock & Wilcox boilers is, in the writer's opinion, detrimental, and should not be encouraged when it is at all possible to introduce any necessary purifying agents into the water before it reaches the boiler.

PETROLEUM IN ENGLAND.

By W. H. BOOTH.

It has been known to a few for some weeks that petroleum had been discovered in England at two spots at least. The facts have now got into the daily Press, and considerable interest has been aroused. Last year, as the result of my study of the geology of the London area in connection with artesian work, the conclusion was more than ordinarily forced under my observation that the disturbed stratification shown over the South-East of England, the numerous faults on the Weald, and the evidences of folding, all had their origin at some considerable depth below surface.

The many attempts, chiefly fruitless, to find the lower greensand formation in, and around, London, proved practically conclusively that during the geological period embracing this stratum and the one above it—viz., the gault clay, the sea level was from 600 to 1,000 ft. lower relatively to the shore than it is to-day; that the land was in turn rising and falling, and that between these two stratifications what land there was consisted of rocks of the age of those in the West Country.

My successful boring to the lower greensand near Woking, where the sand was found at 1,571 ft. deep, or just about the mean of my limit estimates of 1,550-1,600, confirmed the conclusions arrived at by coinciding so closely with the estimate. As a result, in the new edition of "Liquid Fuel" I anticipated oil being found in England. Now it has been found.

The conclusions to be drawn from the results of the borings made during the past 40 or 50 years are that modern England was laid down on a very ancient foundation, and that since the modern or recent rocks were deposited there has been a great disturbance of this old foundation.

There is great probability that oil may have an inorganic origin, though personally I have had a leaning towards the organic origin. The disturbances alluded to would, however, tend towards conditions favourable to oil production, and our surface indications of deep-seated contortions, and the facts disclosed by deep boreholes appear quite to justify the expectation of oil. So far, of course, not much has been found, but a fairly plentiful supply at one place and actual oil, though small in quantities, at Willesden, are scarcely likely to have been casually dropped upon by the drill, unless there is a fairly wide spread of petroliferous ground.

Even in proved copiously-yielding countries, the location of a borehole is a factor of some importance; usually one drills upon the crest or on the upper slopes of an anticlinal fold, for the superior gravity of water enables it to displace oil in the synclinal folds. So much is this the case, that in some places a line of derricks may be seen to occupy a very narrow tract of land over the syncline, each well indicating the depths and assisting to keep the line.

Really copious boreholes yet remain to be developed in England, and the best localities for future boring must be found. Assuming that they will be found, and that petroleum will be found in large quantities, it is impossible to forecast the future. With our coal supplies becoming more difficult to mine, with much of our coal being actually thrown away by the strike disturbances, and the drowning of pits that will not again be unwatered, the presence and aid of oil would be a great boon to this country, and particularly welcome for the Navy.

Nor need it cause much wonder that there is oil on this side the North Sea, for it is found as near as Hanover. The depth here is great, but not excessive. The wells cannot be called shallow wells, but there are many of greater depth.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

SWEDEN.—The Board of Trade point out that in Group 13B of the Swedish Customs Tariff (electrical machines and apparatus), under which stators, rotors, current collectors, magnet poles, brush-holders and hanks (härfvor) imported separately, are dutiable as electrical machines with a surtax of 50 per cent., it is provided that this surtax shall not be levied in the case of an article which is proved to be imported as a substitute for a worn-out or otherwise useless part of a machine imported previously.

A recent Swedish Royal Decree prescribes that importers who desire to avail themselves of this concession must deliver to the Customs Administration an assurance on their word of honour that the imported parts are intended to replace a worn-out or otherwise useless part of a machine of foreign manufacture on which full import duty was paid. The accuracy of such assurance must be attested by two responsible persons, and it must contain particulars as to the date of importation of the part which has become unfit for use.

The same Royal Decree lays down the following general regulations as regards imports of machinery into Sweden:—If an importer fails to supply the description, specification or drawing referred to in Note 1 to Section 13A of the Tariff * or if the documents furnished do not afford a satisfactory basis for assessing duty, the necessary particulars must be ascertained by experts summoned by the Customs Administration at the expense of the importer. If the Customs consider it necessary, the person declaring the goods for payment of duty or for warehousing must either himself furnish a written assurance on his word of honour that the consignment does not contain portions of other machines or spare parts of the imported machines other than such portions as go to make up the machine itself, or in case he is not himself the purchaser of the article, he must produce an assurance to this effect from the purchaser If such assurance is not supplied or there is reasonable ground for assuming that the assurance supplied is not in accordance with the facts, the Customs Administration may summon experts to furnish the necessary particulars. In the latter case the cost must be borne by the importer if he has failed to supply the assurance required, or if the assurance he furnished is not in accordance with the facts; in other cases, it shall be borne by the Customs.

When machines are imported in parts, or other causes render it difficult for the Customs official concerned to ascertain the nature of the machine in question, the Customs Office may deliver it on deposit of duty at the highest rate which might be applicable to the goods, after such suitable parts have been marked by lead seals or otherwise, so far as may be considered necessary in order to identify them and to determine the nature of the machine when it has been erected. The expenses of this supplementary inspection shall be borne by the importer in accordance with the scale of fees laid down for the clearance of goods in premises belonging to private persons.

If a machine is imported in parts which arrive on different occasions or by different methods of conveyance, and the importer requests that the rate of duty leviable on the machine as a whole shall be applied, such request shall be notified on the declaration for the consignment which arrives first, and it shall be binding as regards subsequent assessment of duty. Importation of the various parts must take place at one and the same Customs Office, and the importer must furnish sufficient proof when the first importation takes place that all the parts will together form one machine, and he must supply drawings and specifications as to the parts imported on each separate occasion of passing them through the Customs. Proof of payment of duty shall not be issued until all the parts have arrived, but the importer shall be allowed to take possession of the parts as imported on depositing duty at the highest rate applicable to each separate consignment.

The same Royal Decree lays down regulations respecting the proof required of the declared value of imported goods.

* This Note provides that:—

The rates stated are applicable, unless otherwise stated, to machines, whole or in parts, even if any subordinate component parts are missing.

In declaring machines which are imported in a "knocked down" state (*i.e.*, taken to pieces) for clearance or warehousing, the owner must supply an explanatory statement and specification of the parts, together with a drawing showing that the parts together form a machine—so far as these may be required for the guidance of the Customs.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

5,992. "Insulator-carrying brackets or arms of telegraph and like poles." Bullers, Ltd., and E. H. Chambers. March 11th.

6,047. "Electric generators." E. F. Bremner and J. W. Hewat. March 11th.

6,049. "Electrical step-by-step translating devices." L. M. Potts. March 11th. (Complete.)

6,050. "Electrical signalling apparatus." L. M. Potts. (Convention date, November 18th, 1911, United States.) March 11th. (Complete.)

6,052. "Electrical conduit fittings." L. G. Byng and T. Taylor. March 11th.

6,061. "Means for decreasing the injurious effects due to capacity in electric conductors." F. A. Becker. (Convention date, March 11th, 1911, Germany.) March 11th. (Complete.)

6,062. "Sparking plugs." I. Koutrine. March 11th. (Complete.)

6,076. "Igniters." L. D. Vaughan and T. Miller. March 11th. (Complete.)

6,077. "Automatic spark timing mechanism for internal combustion engines." T. Townson. March 11th. (Complete.)

6,078. "Time switches." F. Schmid. (Convention date, August 10th, 1911, United States.) March 11th. (Complete.)

6,099. "Dynamos." M. M. Fouque and C. H. Ruelle. March 11th. (Complete.)

6,101. "Method of regulating the output of dynamos for motor-cars and the like." W. H. Fritz. March 11th.

6,112. "Manually operated electric switches with automatic releasing mechanism." E. T. R. Murray. March 11th. (Complete).

6,116. "Drivers' brake valves for electrically and pneumatically controlled compressed-air brakes." W. Hildebrand and Knorr-Bremse Akt.-Ges. March 11th. (Complete.)

6,139. "Magnetic chucks." H. Humphreys. March 12th.

6,146. "Coupling up conduits and fittings for electrical wiring purposes." F. L. Yates. March 12th.

6,155. "Terminal connections for dynamo-electric machines." H. W. Bosworth and H. C. Siddeley. March 12th.

6,182. "Electric heating devices." Ferranti, Ltd., and J. Roothaan. March 12th. (Complete.)

6,189. "Variable speed dynamos for use in starting internal combustion engines and the like." H. Leitner. March 12th.

6,212. "Systems of electrical distribution." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 12th.

6,248. "Means for connecting electrodes." Gebr. Siemens & Co. (Convention date, March 28th, 1911, Germany.) March 13th. (Complete.)

6,261. "Electrolysis of liquids." J. G. Paulin. March 13th. (Complete.)

6,262. "Acoustic tubes applicable for use with telephone receivers." L. A. L. Struxiano. March 13th.

6,269. "Control of variable speed dynamos such as those employed for train lighting." Electric and Ordnance Accessories Co., Ltd., J. Etchells and E. W. Price. (Addition to 6611/1911.) March 13th. (Complete.)

6,275. "Telegraphy." S. G. Brown. March 13th.

6,286. "Electric insulators." Bullers, Ltd., and G. V. Twiss. March 13th.

6,287. "Electric insulators." Bullers, Ltd., and G. V. Twiss. March 13th.

6,295. "Preparation or forming of metallic-filaments for use in incandescent electric lamps." E. A. Gimingham. March 13th.

6,304. "Electrically-controlled lifts or elevators." A. Rozier. March 13th. (Complete.)

6 305. "Automatic telephone systems." M. Baum. (Convention date, March 13th, 1911, Germany). March 13th. (Complete.)

6,392. "Method of and apparatus for regulating electric currents." J. S. Goodwin, J. A. J. Haslop and T. H. Brown. March 14th.

6,393. "Telephonic transmitters." L. A. L. Struxiano. (Convention date, March 14th, 1911, Belgium.) March 14th. (Complete.)

6,395. "Holders for electric lamps, electric switches, ceiling roses, blocks and the like." A. R. Muller. March 14th.

6,396. "Holder for telephones." J. B. Potter. March 14th.

6,398. "Electric ignition of internal combustion engines." L. Revault. (Convention date, March 18th, 1911, France.) March 14th. (Complete.)

6,441. "Means for the transmission of signals, telegraphic and other communications over high-tension transmission lines." F. Giraud-Teulon. March 15th. (Complete.)

6,473. "Insulating supports for the conductor rails of electric railways." E. T. Brook. March 15th.

6,486. "Means for producing electro-magnetic waves of high group frequency and the application thereof to wireless telephony." W. T. Ditcham, H. G. Matthews and Grindell Matthews Wireless Telephone Syndicate, Ltd. March 15th.

6,487. "Electric incandescent lamps." A. C. Hyde. March 15th.

6,496. "Electric motor for transmitting angular movements, with an auxiliary motor which controls the successive displacements for it." R. Girardelli. (Convention date, March 15th, 1911, Italy.) March 15th. (Complete.)

6,498. "Internal combustion engines." Marconi's Wireless Telegraph Co., Ltd., and R. H. White. March 15th.

6,500. "Electrodes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 15th. (Complete.)

6,517. "Electrically operated valve-controlling devices." J. Keith and G. Keith. March 16th.

6,528. "Electric fittings." W. S. Halliwell. March 16th.

6,550. "Transformation of direct currents." Akt.-Ges. Brown, Boveri et Cie. (Convention date, March 17th, 1911, Germany.) March 16th. (Complete.)

6,555. "Electric signal for use on locomotives." R. G. J. Wrightman. March 16th.

6,557. "Electrically heated culinary apparatus." British Westinghouse Electric and Manufacturing Co., Ltd. (Westinghouse Electric and Manufacturing Co., United States.). March 16th. (Complete.)

6,562. "Device for supporting conduits, pipes or the like for electric conductors or other uses." J. B. Blake and W. Kilburn. March 16th.

6,580. "Combined intercommunication and party line telephone systems and the like." Sterling Telephone and Electric Co., Ltd. (Telephone Fabrik Akt.-Ges. vorm. G. Berliner, Germany.) March 16th.

6,596. "Electric welding of metals." E. H. Jones. March 16th.

6,599. "Automatic apparatus for operating electric starting switches and the like." W. A. Clatworthy. March 16th.

Skegness Lighting.—A Sub-Committee of the U.D.C. is visiting Sleaford to obtain information in regard to the electric lighting system in vogue there.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Processes of Separation by aid of Electro-Osmosis. V. B. Schwerin. 27,931. December 12th. (January 25th, 1911. Addition to No. 3,364 of 1911.)

Telephonic Transmitters. W. J. Marchant. 29,195. (Addition to No. 24,390 of 1910.)

Electrically-Controlled Flashlight Apparatus. W. Bale and L. H. Hopkins. 1,360. January 18th.

Electric Current Distributing Systems. G. H. Merz and P. V. Hunter. 4,004. February 16th. (Cognate application, No. 5,189 of 1911.)

Electric Connections and Switch Control. H. F. Joel. 4,019. February 17th.

Apparatus for Perforating the Signal-Controlling Tape to be used with Automatic Telegraph Transmitters. W. Judd, A. Fraser and Eastern Telegraph Co. 4,050. February 17th.

Vapour Electric Apparatus. M. A. F. Leblanc. 4,266. February 20th.

Electric Bells, Gongs and the like. E. R. Grote. 4,414. February 21st.

Control of Electric Regulators. Akt.-Ges. Brown, Boveri et Cie. 4,915. February 27th. (February 25th, 1910.)

Electric Wall-Plugs. S. W. Martyn. 5,986. March 29th.

Electric Imitation Candle Lamps. V. Curtis. 7,306. March 23rd.

Electric Heaters. J. F. Monntt. 8,023. March 30th. (Convention date not granted.)

Direct-Current Electric Machines. J. H. Carrick and Greenwood & Batley, Ltd. 8,589. April 6th.

Mechanism for Timing Electro-Magneto Machines for Explosion Motors. Soc. Rene Gillet et Cie. 9,948. April 24th. (November 29th, 1910.)

Electric Hair-Comb. J. T. Niblett and W. H. Cadman. 10,436. April 29th

Means for Electrically Indicating or Recording the Position, Time and Speed of Trains on Railways. N. T. Jones-Miller. 11,195. May 9th.

Electric Switches. British Thomson-Houston Co. and J. M. Wallace. 12,919. May 29th.

Arc Lamp Electrodes. British Thomson-Houston Co. (General Electric Co.) 13,124. May 31st.

Control of Electric Railway Trolleys or Cars having Electric Hoisting Gear. M. A. Bleichert and M. P. Bleichert. 13,573. June 6th.

Electro Plating or Coating of Cylindrical or like Revoluble Articles. A. Walker. 14,140. June 14th.

Electric Motor Control Systems and Apparatus therefor. British Thomson-Houston Co., Ltd. (General Electric Co.) 15,322. June 30th.

Portable Electric Fuse-Wire Carrier. S. Chase. 15,564. July 4th.

Clock having Electrical Winding Mechanism. N. Gerdes. 15,684. July 6th.

Earthing Devices for Electrical Circuits. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 16,907. July 24th.

Telephone Instruments especially applicable to Receivers. E. C. R. Marks. (G. R. Webb.) 16,954. July 24th.

Safety Device for Electric Cables. Siemens-Schuckertwerke Ges. 17,046. July 25th. (July 25th, 1910.)

Terminals for Electric Storage Batteries. O. Oldham. 17,612. August 2nd.

Receiving Apparatus for Electric Transmission of Signals. H. A. Schepeler. 17,978. August 8th. (August 5th, 1910.)

Transmitter for Wireless Telegraphy. W. T. Ditcham. 18,271. August 12th.

Diaphragms and like Sound Receiving and Transmitting Surfaces for Telephones, Gramaphones and other Apparatus. O. Reinhardt. 18,355. August 14th. (March 1st, 1911.)

Direct-Current Motors. F. Vlaminck. 20,298. September 13th.

Circuits for Automatic and Semi-Automatic Telephone Systems. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 21,161. September 25th.

Storage Battery Electrodes. H. C. Hubbell. 21,692. October 2nd.

Process of Making Metal-Foil applicable for use in Storage Battery Electrodes. H. C. Hubbell. 21,784. October 3rd.

Machine for Making Perforated Strips with Check Impressions in Type, or for Electrically Translating Perforated Strips into Typewriting, or for Operating Type Setting, Casting and Impression Machines. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 22,068. October 6th.

Loud-Speaking Telephonic Apparatus. E. A. Graham. 22,358. October 10th.

Alternating-Current Electromagnets. R. A. Barbour. 24,977. November 9th.

1912.

Manufacture of Electric Accumulator Electrodes. S. Pape. 728. Januar 8th. (Divided application on No. 12,019 of 1911. May 18th.)

German Enterprise in France.—The position of the Compagnie Générale d'Electricité of Creil is referred to by the Paris correspondent of a Frankfort newspaper, who represents the matter from the point of view of French interests. It appears from statements made by the French directors at the recent meeting that the company was formed in 1898 with the co-operation of the Schuckert Co., for the working of the latter's patents, to which were added the patents of the Siemens and Halske Co. when a close association was established between those two German firms. The French company was alternately under French and German management without, however, becoming prosperous and it had to be reconstructed. A new French director succeeded in bringing the undertaking into a better position, but the correspondent declares that German interests counteracted this movement and finally entered into arrangements with the French Creusot Works for the production of Siemens-Schuckert plant for the conversion of railways to electric traction. As a consequence of this measure the four French directors tendered their resignation and the German group, which owns the majority of the shares, appointed two new members to the board. The Frankfort newspaper remarks that the Siemens-Schuckert Works will now probably express an opinion on the French representation of the situation of affairs.